CANNONBALL RIVER TMDL IMPLEMENATION PROJECT

SNAKE CREEK CONFLUENCE TO CEDAR CREEK CONFLUENCE

1.0 PROJECT SUMMARY SHEET

PROJECT TITLE AND NAME:
Cannonball River TMDL Implementation Project Snake Creek Confluence to Cedar Creek Confluence

NAME AND ADDRESS OF LEAD PROJECT SPONSORS/SUBGRANTEES:

Grant County Soil Conservation District
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STATE CONTACT PERSON: Greg Sandness **TITLE**: Environmental Scientist

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STATE: North Dakota. **WATERSHED:** Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek **LOCATION:** Grant County

HYDROLOGIC UNIT CODE: ND-10130204-001-S
HIGH PRIORITY WATERSHED: Yes

PROJECT TYPES	WATERBODY TYPES	NPS CATEGORY
[x] STAFFING & SUPPORT	[ ] GROUNDWATER	[x] AGRICULTURE
[x] WATERSHED	[ ] LAKES/RESERVOIR	[ ] URBAN RUNOFF
[ ] GROUNDWATER	[x] RIVERS	[ ] SILVICULTURE
[x] I & E	[x] STREAMS	[ ] CONSTRUCTION
	[ ] WETLANDS	[ ] RESOURCE
		[x] OTHER

MAJOR GOAL: The primary goal is to restore and/or protect the two primary beneficial uses (i.e. recreational and agricultural) of the Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek by reducing the geometric mean concentrations of fecal coliform bacteria to no more than 10% of the samples not to exceed 400 CFU/100 mL

PROJECT DESCRIPTION: The Cannonball River TMDL Implementation Project will implement comprehensive conservation plans using best management practices to address project goals. Information and educational programs will heighten public awareness regarding items that contribute to the concerns of non-point source pollution.

FY 2007-2011 **319 Fund Requested $** 165,065 **Match** $ 257,943

Other Federal Funds $ 44,500 **Total Project Cost $ 467,508**

2.0 STATEMENT OF NEED

The Cannonball River TMDL Implementation Project targets 34.16 miles of the Cannonball River which is fully supporting, but threatened due to excessive fecal coliform bacteria concentrations. Animal feeding operations (AFO) and riparian grazing are the most likely sources of the fecal coliform bacteria affecting the beneficial uses of the Cannonball River. Twelve high priority AFOs needing to be addressed may exist out of 40 possible AFOs in the watershed. The total miles of targeted river reach that have grazing land immediately adjacent to it is about 27.38 miles.

2.1 The Grant County Soil Conservation District has long recognized the natural, economic, and recreational value of the Cannonball River and its surrounding watershed. Maintenance of the river's water quality and improved soil land management are high priorities. "The Cannonball River TMDL Implementation Project will be the first step toward addressing all the water quality improvement needs of the Cannonball River within in Grant County."

The Cannonball River flows through five counties in southwest North Dakota, providing recreational and agricultural water supply while it delineates county lines as it flows into Lake Oahe. Originating in the northeast corner of Slope County, the Cannonball River winds its way in a southeasterly direction across Hettinger and Grant Counties where it confluences with Cedar Creek. At its confluence with Cedar Creek, the Cannonball River changes direction flowing northeast bisecting Sioux and Morton counties where it discharges into Lake Oahe. "The Cannonball River TMDL Implementation Project will focus on a 34 mile reach of the river within Grant County. A map of the watershed for this reach is provided in Appendix #2."

2.2 Based on the "2004 Section 303(d) List of Impaired Waters needing TMDL's (NDDoH, 2004), the North Dakota Department of Health has identified a 34.16 mile segment of the Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek (ND-10130204-001-S 00) as fully supporting, but threatened for recreational uses (See Appendix #1). Recreational uses on the Cannonball River are threatened due to excessive fecal coliform bacteria concentrations. Fecal coliform bacteria levels periodically exceed the State Standard, and E. coli bacteria originating from human sources have been discovered in the river. Being a high priority area a TMDL (Total Maximum Daily Load) was written and open for public comment on this segment of the Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek and finalized in March of 2005. This 34.16 mile segment of the Cannonball River has approximately 110,403 acres (hydrologic unit 10130204) with an average of 16 inches of rainfall a year. "A copy of the approved TMDL is provided in Appendix #1."

NPS pollutants impairing recreational uses are fecal coliform and E. coli. Fecal coliform data was collected between 1994 and 2003 and based on this data the following use support decision criteria were used:

Criterion 1: The geometric mean of the samples should not exceed 200 CFU/mL.
Criterion 2: Not more than 10 percent of the samples should have a density exceeding 400 CFU/100 ml.

The two criteria were then applied using the following use support decision criteria:

Fully supporting: Both criteria 1 and 2 are met.
Fully supporting but Threatened: Criterion 1 is met, but 2 are not.
Not supporting: Criterion 1 is not met, or Criteria 1 and 2 are not met.

With a geometric mean of 153 CFU/100 mL, the first criterion was met. However, twenty-four percent of samples exceed 400 CFU/100 indicating recreational uses were fully supporting, but threatened. Summary of Fecal Coliform Bacteria Sampling Results for Grant County. (See Appendix #1).

TMDL recommendations include livestock BMPs that are designed to promote healthy water quality and riparian areas through management of livestock and associated grazing land. Fecal matter from livestock and erosion from poorly managed grazing land and riparian areas can be a significant source of fecal coliform bacteria loading to surface water. These specific BMPs are known to reduce NPS pollution from livestock which include:

- Livestock exclusion from riparian areas; this practice is established to remove livestock from grazing riparian areas and watering in the stream.
- Water well and tank development; fencing animals from stream access requires an alternative water source, installing water wells and tanks satisfies this need.
- Prescribed grazing; to increase ground cover and ground stability by rotating livestock throughout multiple fields.
- Waste management system; waste management systems can be effective in controlling up to 90% of fecal coliform loading originating from confined animal feeding areas.

2.3 The Cannonball River TMDL Implementation Project includes the Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek. The watershed priority areas consist of ½ mile from the riparian area of the main stream and/or the main tributaries that drain directly into the main stream. **A**ttached map.(See Appendix #2).

2.4 The topography of the Cannonball River TMDL Implementation Project in Grant County consists of short grass prairie rolling plains with prominent sandstone buttes. Elevation of the area is predominately flat with elevation ranges between 1,800-feet in the southeast corner of the county to 2,700-feet in the southwest corner. The climate is semiarid with an average of 16 inches of total annual precipitation. Glaciation has had little to no effect on the topography of the area leaving original soils in place and a complex stream drainage system.

3.0 PROJECT DESCRIPTION

3.1 GOAL:

Achieve fully supporting status for the recreational uses on the portion of the Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek.

3.2 **OBJECTIVE 1:**

Maintain the geometric mean concentrations for fecal coliform bacteria below 200 colonies/100 mL and reduce the occurrence of single samples exceeding 400 colonies/100 mL to represent less than 10% of samples.

TASK 1: Employ a Watershed Coordinator to provide one-on-one conservation planning assistance to producers in the project area.

Product: 1 Watershed Coordinator

Cost: $130,875

TASK 2: Employ a part time Administrative Assistant to provide accounting assistance.

Product: 1 Administrative Assistant

Cost: $2,940

TASK 3: Provide financial and technical assistance to producers to plan and install BMP's that will improve grazing management on 30,000 acres of the range/pasture land within ½ mile from the riparian area of the main stream or its tributaries of the Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek watershed.

Product: 30,000 acres of prescribed grazing within ½ mile of the riparian area of the main stream or its tributaries.

Cost: $134,793

TASK 4: Coordinate with the Department of Ag or the Stockmen's Association to design and implement 12 Ag Waste Systems within ½ mile of the riparian area of the main stream or its tributaries.

Product: 12 approved/permitted manure management systems

Cost: "Financial support will be coordinated through the ND Stockmen's Association Environmental Services Program, ND Dept. of Ag Dairy Pollution Prevention Program, and/or NRCS-EQIP."

OBJECTIVE 2:

Increase livestock producers' awareness and understanding of various management options that will reduce or prevent the delivery of livestock manure to nearby waterbodies."

TASK 5: Organize and conduct scheduled I/E events focusing on manure management practices and manure utilization.

Product: (5) Workshops

Cost: $2,500

TASK 6: Organize and conduct scheduled I/E events focusing on manure management practices and manure utilization.

Product: (10) Tours/demonstrations.

Cost: $4,000

TASK 7: Organize and conduct scheduled I/E events focusing on manure management practices and manure utilization.
Product: *(5)* Informational Meetings
Cost: *$2,500*

3.3 See Milestone Table. (See Appendix #4).

3.4 All necessary permits will be acquired as needed, (i.e. Cultural Resources Reviews, 404 permits, and NDDoH permits).

3.5 The Grant County Soil Conservation District (GCSCD) is the appropriate entity to coordinate and implement this project. The SCD is a locally elected volunteer conservation organization that serves all the people in the county. The GCSCD has legal authorization to employ personnel and receive and expend funds. The GCSCD has sponsored one other 319 project.

3.6 The Grant County Soil Conservation District will be responsible for auditing Operations & Maintenance Agreements (O&M) on BMP's after completion of the project and yearly status reviews of EPA-319 contracts. The lifespan of each BMP will be listed in the individual contracts to ensure longevity of the practices. The producer signs the "EPA 319 Funding Agreement Provisions" form which explains in detail the consequences of destroying a BMP before the completion of its lifespan.

4.0 COORDINATION PLAN

4.1 This project is sponsored by the Grant County Soil Conservation District (GCSCD). Partners in the project will also include Natural Resources Conservation Service. The GCSCD will be the lead project sponsor.

1. Grant County Soil Conservation District – The lead project sponsor is the GCSCD. The ND State Health Department will hold a contracting agreement with the district to implement and complete the objective and tasks in this plan.

2. USDA Natural Resources Conservation Service (NRCS) – The NRCS will provide day to day assistance in conservation planning, plan writing, contract writing, and technical assistance for construction and installation of planned BMPs. NRCS personnel will conduct quality review and compliance checks of BMPs that are designed by NRCS personnel. Local NRCS personnel will provide approved BMP standards and specifications from the NRCS technical guide. Environment Quality Incentive Program funds will also be available in limited amounts. (NRCS will provide assistance by facilitating local involvement and participating in educational outreach programs during the project period. An annual review will be conducted with Field Office, DC, and the SCD to reconfirm and acknowledge NRCS's ability to commit to the project).

3. North Dakota Department of Health (NDDH) – The NDDH will oversee 319 funding as well as provide training for proper water quality sample collection, preservation, and transportation to ensure reliable data is obtained. The NDDH will provide the sponsor oversight to ensure proper management and expenditures of Section 319 funds. They will assist the Grant SCD personnel in review of O & M requirements for Section 319 funded BMP's.

4. North Dakota Cooperative Extension Service (EXT) – Fully supports this project, complement project with education and informational activities which entails workshops and field tours. The specific role of EXT will be dependent on the type of information/education activity being implemented and availability of staff and materials.

5. Grant County Commission – Fully supports the project, technical assistance will be provided when necessary.

6. Grant County Water Resource Board (WRB) – Fully supports the project, technical assistance will be provide when necessary.

7. North Dakota Game & Fish Department (NDG&F) – Fully supports the project, technical assistance will be provided when necessary.

8. US Fish and Wildlife (USF&W) – Fully supports the project, programs and technical assistance available when necessary.

9. The Bureau of Reclamation- supports and fully endorse efforts to help conserve and protect our water resources.

4.2 Letters of support for this project is on file from adjoining Counties, Grant County Commissioners, Natural Resource Conservation Service, Grant County Water Resource Board, North Dakota Forest Service, North Dakota Cooperative Extension Service, ND Game & Fish Department, Bureau of Reclamation, and US Fish & Wildlife.

4.3 The Grant County Soil Conservation District will coordinate along with other 319 and non-319 funded NPS education programs, watershed projects, demonstration sites, and training programs being conducted by other organizations, which include the Department of Ag, Stockmen's Association, and LFAP.

The Cannonball River TMDL Implementation Project will coordinate with the Stockmen's Association, ND Department of Ag Dairy P3, and NRCS to design and install the 12 manure management systems scheduled. (See Task 4). Engineering assistance to design the manure management systems will be obtained through the Livestock Facility Assistance Program and/or NRCS.

4.4 The Grant County SCD is currently working with the USDA EQIP program and USDA agencies like NRCS, FSA, and RC&D, working relations have already been established.

5.0 EVALUATION AND MONITORING PLAN

"The primary goal of the project is to implement corrective measures that will address the beneficial use impairments identified in the TMDL for the project area. Given this connection to an approved TMDL, the quality assurance project plan (QAPP) for this project was designed to be consistent with the original TMDL monitoring goals and objectives. A copy of this project's QAPP is attached in Appendix #3.

5.1 A TMDL was written for the proposed project area by the North Dakota Health Department and finalized in March of 2005. A Quality Assurance Project Plan (QAPP) will also be written by the North Dakota Health Department upon the approval of this project. The QAPP will be consistent with the TMDL.

5.2 Beneficial use and water quality improvements throughout the project period will be documented and the appropriate training and collecting of samples will be done as scheduled. Monitoring will track the annual, seasonal, and daily hydrologic, nutrient, total suspended solids, and fecal coliform bacteria loading at assigned STORET sites in the watershed. The North Dakota Health Department personnel will track water sampling data received and provide data interpretation to project personnel for their required reports.

5.3 Not applicable.

5.4 Not applicable

5.5 Financial support for long-term operations and maintenance will be the responsibility of the cooperating producers.

6.0 BUDGET

6.1 See Appendix #5.

7.0 PUBLIC INVOLVEMENT

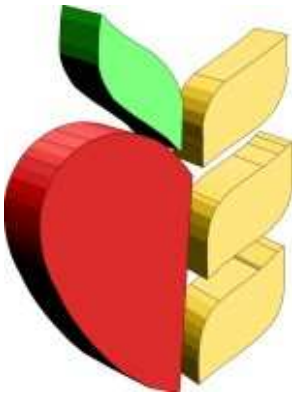
7.1 Information and education meetings will be held to keep the community informed. Community leaders, commissioners, water resource board members, city mayors, and district supervisors have been and will be involved in decision-making processes involving the implementation of the project.

Appendix #1

Total Daily Maximum Load

(TMDL)

Cannonball River, North Dakota
Bacteria Total Maximum Daily Load



North Dakota Department of Health
Division of Water Quality
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1.0 INTRODUCTION AND DESCRIPTION OF THE RIVER AND WATERSHED

The Cannonball River flows through five counties in southwest North Dakota, providing a recreational and agricultural water supply while it delineates county lines as it flows to Lake Oahe. Originating in the northeast corner of Slope County, the Cannonball River winds its way in a southeasterly direction across Hettinger and Grant Counties where it confluences with Cedar Creek. At its confluence with Cedar Creek, the Cannonball changes direction flowing northeast bisecting Sioux and Morton counties where it discharges into Lake Oahe near the town of Cannonball, North Dakota (Figure 1). Encompassing two sub-basins, the Cannonball River watershed is part of the Missouri River Basin. General characteristics of the Cannonball River and its watershed are outlined in Table 1. The segment of the Cannonball River listed on the State's 2004 303(d) list is 34.16 miles in length and approximately 110,403 acres of land drain to it in hydrologic unit 10130204. This Section 303(d) listed stream segment (ND-10130204-001-S_00) and its accompanying watershed will be the focus of this TMDL report (Figure 2).

1.1 Clean Water Act Section 303(d) Listing Information

Based on the "2004 Section 303(d) List of Impaired Waters needing TMDLs" (NDDoH, 2004), the North Dakota Department of Health (NDDoH) has identified a 34.16 mile segment of the Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek (ND-10130204-001-S_00) as fully supporting, but threatened for recreational uses (Table 2). Recreational uses on the Cannonball River are currently fully supported, but threatened due to excessive fecal coliform bacteria concentrations. Fecal coliform bacteria levels periodically exceed the State standard, and E. coli bacteria originating from human sources have been discovered in the river.

1.2 Topography

The Section 303(d) listed segment of the Cannonball River highlighted in this TMDL is located in Grant County (Figure 2). Topography of the Cannonball River watershed in Grant County consists of short grass prairie rolling plains with prominent sandstone buttes. Elevation of the area ranges between 1,800-feet (MSL) near Shields, North Dakota to 2,700-feet (MSL) at the top of Coffin Butte south of New Leipzig (Soil Survey of Grant County, USDA Soil Conservation Service, 1988). Glaciation has had little to no effect on the topography of the area leaving original soils in place and a complex stream drainage system.

Table 1. General Characteristics of the Cannonball River and its Watershed.

Legal Name	Cannonball River
8-Digit HUC	10130204 and 10130206
Counties Traversed	Slope, Hettinger, Grant, Sioux, Morton Counties
Eco-region	Northwestern Great Plains (Level III), Missouri Plateau (Level IV)
Watershed Area	1,619,734 acres
Head Waters	Northeast Slope County
Outlet	Lake Oahe
ND Highways Crossed	Hwy 21, Hwy 22, Hwy 8, Hwy 49, Hwy 31, Hwy 6, Hwy 1806
Stream Class	Class II
Headwater Elevation	2770 feet
Outlet Elevation	1611 feet
River Length	346 miles
Annual Mean Stream flow for Year 2001	295 ft^3/s

Table 2. Cannonball River Section 303(d) Listing Information (NDDoH, 2004).

Assessment Unit ID	ND-10130204-001-S-00
Waterbody Description	Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek
Size	34.16 miles
Designated Use	Recreation
Stream Class	Class II
Use Support	Fully Supporting, but Threatened
Impairment	Total Fecal Coliform Bacteria
TMDL Priority	High, Targeted

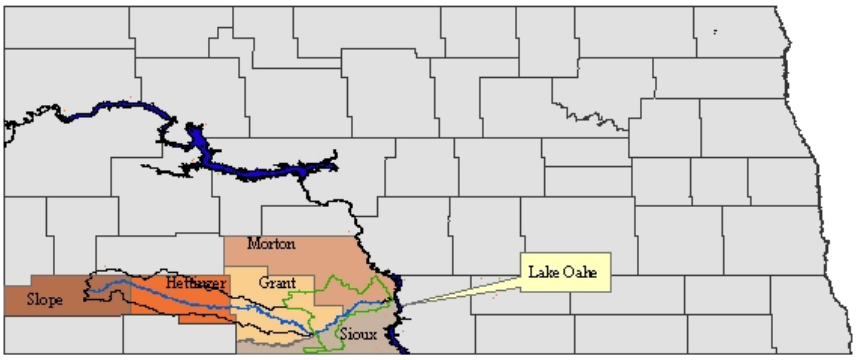

Figure 1. Cannonball River in North Dakota

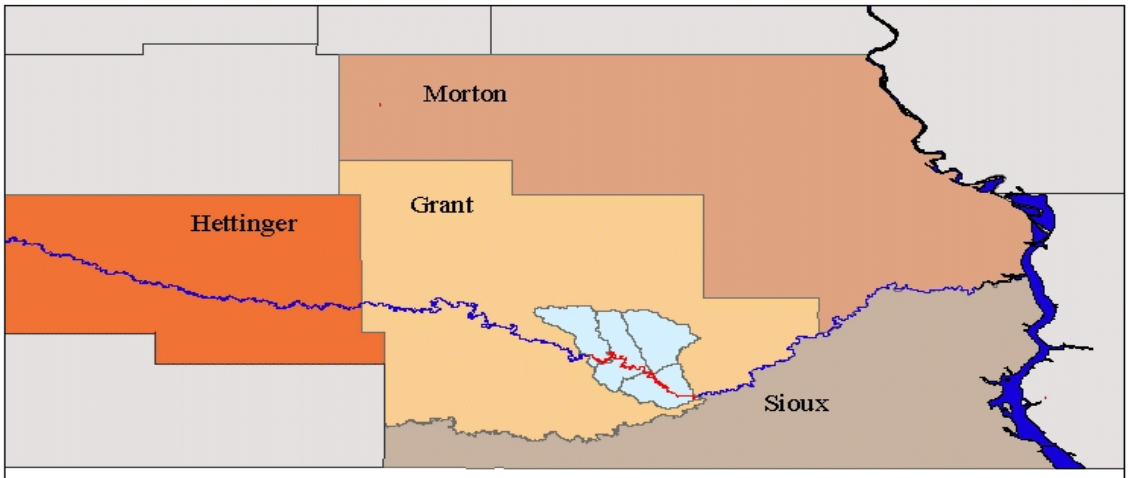

Figure 2. Location of the Cannonball River TMDL Listed Segment and its watersheds

1.3 Land Use/Land Cover

Land use in the Cannonball watershed is primarily agriculture (Figure 3). Since 80 percent of the county being pasture or rangeland (Table 3) the primary agricultural practice is livestock production, specifically cow-calf operations. Thin top soils of siltstone, sandstone, and shale minimize crop production leaving range and pasture land consisting of short grass prairie, forbs, and a wide variety of forage ideal for beef production. Crop production consists of small grain crops such as spring wheat and barley and accounts for approximately 6 percent of the land use. With the advent of no-till and minimum till technologies, the region is seeing an increase in higher water use crops such as corn that is grown and cut for feed silage, flax, sunflower, and canola.

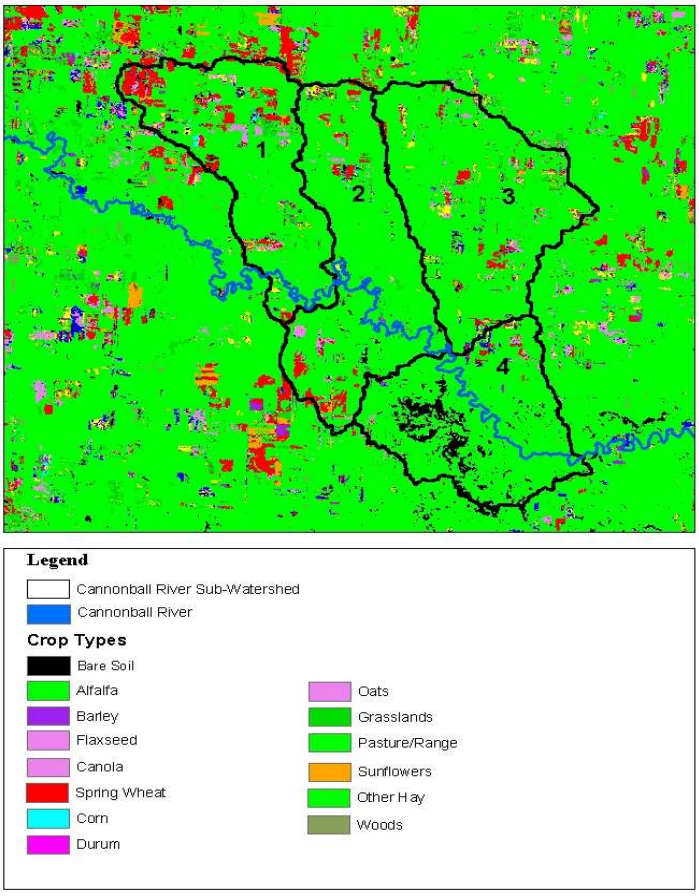

Figure 3. Land Use Data in the Cannonball River Watershed (NDSU, 2003).

Other land uses include roads, water, and woods. New Leipzig, Elgin, and Carson are the more sizable towns in Grant County but are quite small taking into consideration the total population of Grant County in 2001 was 2,775 residence, (U.S. Census Bureau, 2001).

Table 3. Land uses and their Respective Acreage in the Cannonball River Watershed.

Land use	Sub-Watershed					
	1 (Acres)	2 (Acres)	3 (Acres)	4 (Acres)	Total Acres	%
Pasture/range	18606	24446	24997	20578	88633	80
Grasslands	906	688	982	134	2710	2
Other hay/alfalfa	1323	1446	2167	602	5538	5
Small grain (wheat,oats,barley)	3048	1882	1671	502	7102	6
Row crops (corn, sunflower)	303	122	76	1	502	.04
Other crops (soybean, flax)	505	364	727	136	1732	2
Bare soil	313	336	186	2535	3369	3
Water	182	89	266	166	702	.06
Woods	15	24	37	27	103	.01

1.4 Climate and Precipitation

Southwest North Dakota has a climate characterized by severe fluctuations in temperature, precipitation, near continuous air movement, and low relative humidity. Temperatures of the region range from a monthly average of 27°F in January to 85°F in August with an annual average of 56° F over the last twenty years, (NDAWN, 2003) (Figure 4).

Precipitation events are sporadic occurring primarily as rainfall in late spring and early summer (Figure 5). Based on precipitation records obtained from the North Dakota Agriculture Weather Network (NDAWN) station at Mott, North Dakota (NDAWN, 2003), average annual precipitation is 15.76 inches (NDAWN 2003).

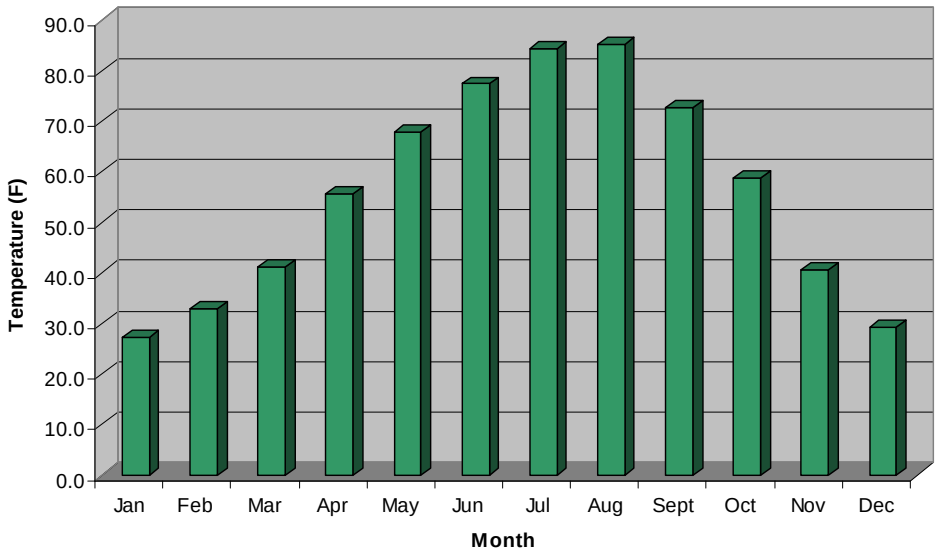

Figure 4. Average Monthly Temperatures From 1983-2002 at North Dakota Agriculture Weather Network (NDAWN), Mott, ND Weather Station.

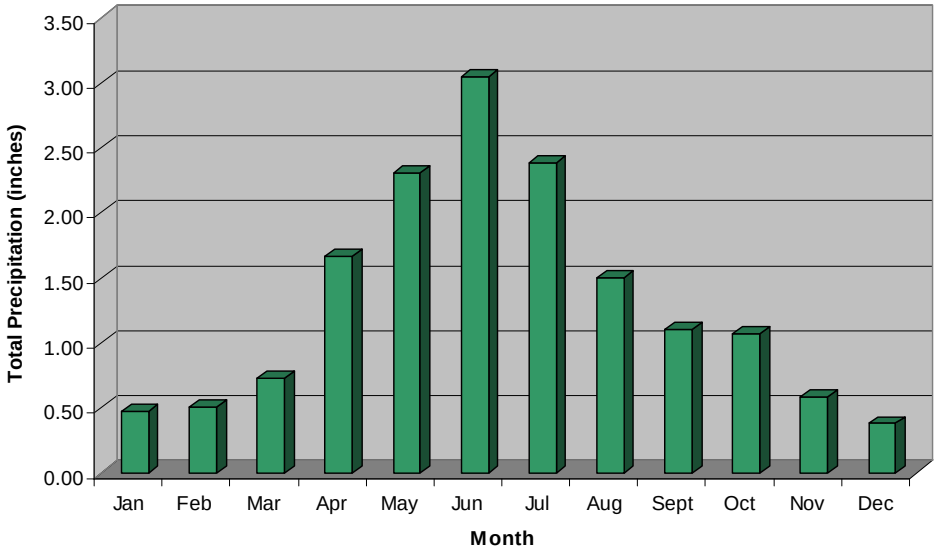

Figure 5. Average Monthly Precipitation from 1983-2002 at NDAWN, Mott, ND Weather Station.

1.5 Available Stream Water Quality Data

Fecal coliform and E. coli samples were collected at three locations within the impaired reach (Figure 6). One site, station 380105, is located near the downstream end of the reach. In addition to data collected specifically for this TMDL, this site also has ambient monitoring data collected from 1994-2002. Stations 385136 and 385137 were monitored during the recreation season May 1 through September 30, 2001 and 2002. Monitoring station 380105 is located sixteen miles south of Raleigh, North Dakota at the North Dakota Highway 31 bridge and is located near United States Geological Survey (USGS) gaging station number 06351200. As stated previously this site is a NDDoH ambient monitoring station that has been regularly monitored since 1994. The sample frequency for this site was every six weeks during the recreation seasons of 1994 through 2000. In support of this TMDL, sample frequency was increased to twice per week during the 2001 and 2002 recreation season. In addition, monitoring at stations 385136 and 385137 began in 2001 and continued through 2002 to supplement TMDL development. To coincide with site 380105, sample frequency at sites 385136 and 385137 was also set at twice per week during the recreation season of 2001 and 2002.

Location descriptions and statistics for water quality data for each monitoring station are shown in Table 4. Station 380105 is the furthest downstream site and has the highest percent of samples exceeding the water quality standard with 42 percent of the samples above the 200 colony forming units (CFU) per 100 mL state standard. Station 385137 is the next upstream site where 20 percent of the samples collected exceed the water quality standard. Of the three stations, station 385136 is the furthest upstream and had the lowest percent of samples above the standard with 13 percent exceeding. Maximum fecal coliform bacteria concentrations at stations 385136 and 385137 were recorded as greater than 1600. Station 380105 had a maximum concentration of 6700 CFU/100 mL.

Table 4. General Statistics for Water Quality Data and Monitoring Station Descriptions.

STORET	Location Description	# Collected / Years Collected	Max.	Min.	Geometric Mean	% Greater than 400 CFU per 100 mL	% Samples Exceeding the 200 CFU 100 mL Standard
385136	One mile E. and 13 miles S. of Carson	40 / 2001-2002	>1600*	10	78	<1	13
385137	Four miles E. and 13 miles S. of Carson	40 / 2001-2002	>1600*	10	100	<1	20
380105	Sixteen miles S. of Raleigh @ HWY 31 bridge	61 / 1994-2002	6700	10	153	24	42

*Some of the samples returned results of “too numerous to count” and a value of > 1600 was used in these situations.

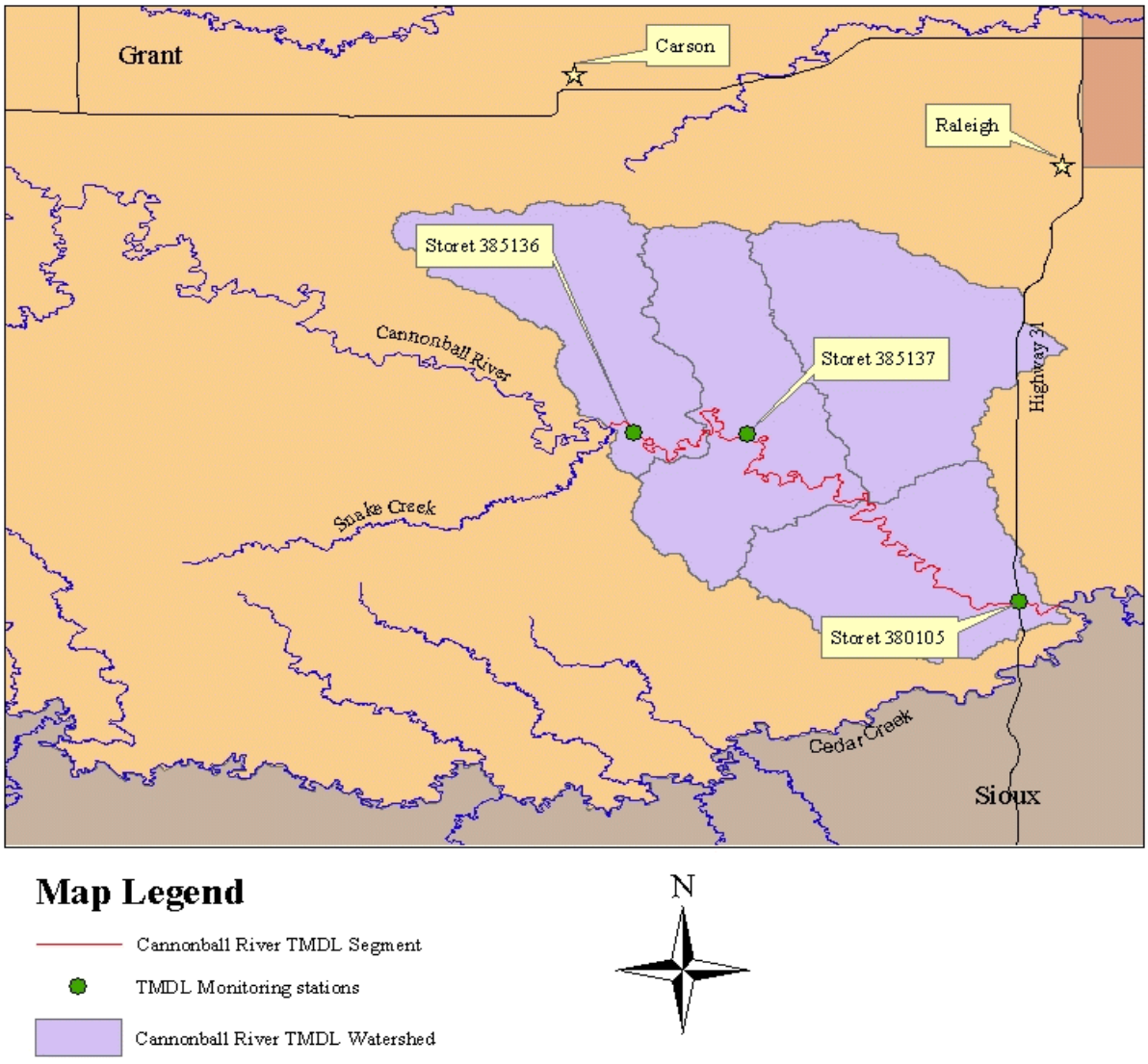

Figure 6. Cannonball River Monitoring Stations

The segment of the Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek (ND-10130204-001-S_00) is listed as fully supporting, but threatened for recreational uses (NDDoH, 2004). A fully supporting but threatened recreational use assessment was made using fecal coliform data collected between 1994 and 2003 at station 380105 and extrapolated upstream to the end of the assessment unit. Based on these fecal coliform data, the following use support decision criteria were used:

Criterion 1: The geometric mean of the samples should not exceed 200 CFU/100 mL.
Criterion 2: Not more than 10 percent of the samples should have a density exceeding 400 CFU/100 mL.

The two criteria were then applied using the following use support decision criteria:

Fully Supporting: Both criteria 1 and 2 are met.
Fully Supporting but Threatened: Criterion 1 is met, but 2 is not.
Not Supporting: Criterion 1 is not met, or Criteria 1 and 2 are not met.

A geometric mean of 153 CFU/100 mL was calculated for station 380105 indicating that criterion one was met. Twenty-four percent of samples exceed 400 CFU/100 mL (Table 4) indicating that criterion two was not met. Based on these two criteria a fully supporting but threatened use support decision was reached.

2.0 WATER QUALITY STANDARDS

The Cannonball River is not meeting its designated use for recreation due to total fecal coliform bacteria levels that exceed the State water quality standard. The fecal coliform standard applicable to the Cannonball River is 200 CFU/100 mL. This standard only applies during the recreation season from May 1st to September 30th. State narrative standards are also applicable and are discussed in Section 2.1 of the TMDL.

2.1 Narrative Water Quality Standards

The North Dakota Department of Health has set narrative water quality standards that apply to all surface waters in the State. The narrative general water quality standards are listed below (NDDoH, 2001).

- All waters of the State shall be free from substances attributable to municipal, industrial, or other discharges or agricultural practices in concentrations or combinations that are toxic or harmful to humans, animals, plants, or resident aquatic biota.

- No discharge of pollutants, which alone or in combination with other substances, shall:
  a. Cause a public health hazard or injury to environmental resources;
  b. Impair existing or reasonable beneficial uses of the receiving waters; or
  c. Directly or indirectly cause concentrations of pollutants to exceed applicable standards of the receiving waters.

In addition to the narrative standards, the NDDoH has set a biological goal for all surface waters in the State. The goal states that “the biological condition of surface waters shall be similar to that of sites or waterbodies determined by the department to be regional reference sites” (NDDoH, 2001).

2.2 Numeric Stream Water Quality Standards

The Cannonball River is a Class II stream. The NDDoH definition of a Class II stream is shown below (NDDoH, 2001).

> **Class II -** The quality of the waters in this class shall be suitable for the propagation and/or protection of resident fish species and other aquatic biota and for swimming, boating, and other water recreation. The quality of the waters shall be for irrigation, stock watering, and wildlife without injurious effects. After treatment consisting of coagulation, settling, filtration, and chlorination, or equivalent treatment processes, the water quality shall meet the bacteriological, physical, and chemical requirements of the department for municipal or domestic use. Additional treatment for municipal use may be required to meet the drinking water requirements of the Department. Streams in this classification may be intermittent in nature which would make these waters of limited value for beneficial uses such as municipal water, fish life, or irrigation.

Numeric criteria have been developed for Class II streams for fecal coliform bacteria. Fecal coliform bacteria guidelines have been established and are shown in Table 5. The fecal coliform standard applies only during the recreation season from May 1 to September 30.

Table 5. North Dakota Fecal Coliform Bacteria Guidelines for Class II Streams.

Parameter	Guidelines (max)	Recreation Season
Fecal Coliform Bacteria	200 CFU/100mL	May 1 to Sept. 30

3.0 TMDL TARGETS

A TMDL target is the value that is measured to judge the success of the TMDL effort. TMDL targets must be based on State water quality standards, but can also include site-specific values when no numeric criteria are specified in the standard. The following TMDL target for the Cannonball River is based on the NDDoH water quality standard for fecal coliform bacteria.

3.1 Cannonball River Targets

The Cannonball River from its confluence with Snake Creek, to its confluence with Cedar Creek is fully supporting but threatened because of fecal coliform bacteria counts exceeding the North Dakota water quality standard. The North Dakota water quality standard for fecal coliform bacteria is 200 CFU/100mL during the recreation season from May 1 to September 30. Thus, the TMDL target for this report is 200 CFU/100mL.

4.0 SIGNIFICANT SOURCES

There are no known point sources in this TMDL listed segment of the Cannonball River. Fecal coliform bacteria and E. coli bacteria polluting the river are from non-point sources. According to the 2003 National Agricultural Statistics Service (NASS) land use/land cover data, the dominant land use/land cover within an estimated 250 meter riparian buffer around the Cannonball is range and pasture at 97 percent. The watershed is entirely rural with 80 percent of the land classified as range or pasture while agricultural crop production accounts for 8 percent (Figure 3, Table 3). With agriculture being predominant, farms and ranches are located throughout the watershed.

To better determine the sources of fecal coliform bacteria, samples were analyzed by Source Molecular to isolate the genetic make up of E. coli. This process is termed "DNA Fingerprinting". The goal of "DNA Fingerprinting" is to determine whether E. coli found in Cannonball River water samples originate from animal or human sources.

Two samples from each monitoring station were analyzed using DNA fingerprinting (i.e. bacteria source tracking) of E. coli to determine if the sources were human or non-human. Both human and animal sources were found in the samples, however, of the 27 isolates, most were found to be animal sources (only 5 of the 27 were determined to be human sources). Animal feeding areas and livestock grazing are likely contributors. Human sources are likely to be from failing septic systems or from the direct discharge of sewage.

Table 6. Results from DNA Analysis of E. coli Isolates at STORET Station 385136.

STORET Station #	Fecal Coliform mpn*/100 mL	E. coli Isolate # (3-5 colonies of cultured E. coli were analyzed)	Probable Source
385136	=210	1	Animal
		2	Animal
		3	Animal
		4	Animal
		5	Animal
385136	=4	1	Animal
		2	Animal
		3	Animal

*mpn=most probable number of fecal coliforms in 100mL of sample after 20 hrs of cultivation at 44.5°C.

It is not surprising that animal E. coli were dominant (Table 6) in samples analyzed as livestock production is a dominant agricultural practice in Grant County. Grant County ranked 4 out of 53 counties in North Dakota with an estimated 80,000 cattle (NDASS, 2003). One NDDoH permitted Concentrated Animal Feeding Operation (CAFO) of 1000 animals or greater is located in the watershed. Twelve Animal Feeding Operations (AFOs) of 100 to 1000 animals and one AFO with 100 animals or fewer are located in the riparian area or in a location where pollution from livestock waste is certain (Espe, 2005). There may be other AFOs, however there location and size are currently unknown.

Wildlife may also contribute to the animal E. coli found in water quality samples, but most likely at lower concentrations. Wildlife are nomadic with fewer numbers concentrating in a specific area, thus decreasing the probability of their contribution of fecal matter in large quantities.

The amount of human E. coli (Tables 7 and 8) is a concern and indicates that failing septic systems or direct discharge sewage systems are most likely located within the watershed. Single family dwellings and farmsteads are located throughout the watershed. These types of dwellings are located on the Cannonball River near two of the three monitoring stations. While it has not been documented, the land application of septic sludge may be another source of contamination. As stated previously, the possibility of point source pollution from waste water treatment facilities is unlikely in the 110,000 plus acre watershed.

Table 7. Results from DNA Analysis of E. coli Isolates at STORET Station 385137.

STORET Station #	Fecal Coliform mpn*/100 mL	E. coli Isolate # (5 colonies of cultured E. coli were analyzed)	Probable Source
385137	=23	1	Animal
		2	Animal
		3	Animal
		4	Animal
		5	Animal
385137	=7	1	Animal
		2	Animal
		3	Human
		4	Animal
		5	Human

*mpn=most probable number of fecal coliforms in 100mL of sample after 20 hrs of cultivation at 44.5 °C.

Table 8. Results from DNA Analysis of E. coli Isolates at STORET Station 380105.

Storet Station	Fecal Coliform mpn*/100 mL	E. coli Isolate # (4-5 colonies of cultured E. coli were analyzed)	Probable Source
380105	=1,100	1	Animal
		2	Human
		3	Human
		4	Human
380105	> 2,400	1	Animal
		2	Animal
		3	Animal
		4	Animal
		5	Animal

*mpn=most probable number of fecal coliforms in 100mL of sample after 20 hrs of cultivation at 44.5°C.

5.0 TECHNICAL ANALYSIS

In TMDL development, the goal is to define the linkage between the water quality target and the identified source or sources of the pollutant (i.e. fecal coliform bacteria) to determine the load reduction needed to meet the target. To determine the cause-and-effect relationship between the water quality target and the identified source, the "load duration curve" methodology was used.

The loading capacity or TMDL is the amount of pollutant (e.g. fecal coliform bacteria) a waterbody can receive and still meet and maintain water quality standards and beneficial uses. The following technical analysis addresses the fecal coliform waste load allocation and load allocation reductions necessary to achieve the water quality standards target of 200 CFU/100 mL with a margin of safety.

In Section 4.0, significant sources of fecal coliform loading were defined as non-point sources originating from failing septic systems and livestock. An important factor in determining NPS pollution loads is variability in stream flows and loads associated with high and low flow. To better characterize the hydrograph of the TMDL listed river segment, a load duration curve was derived for monitoring site 380105 located south of Raleigh, North Dakota (Figure 6). The load duration curve for this site was derived using the 200 CFU/100 mL water quality standard. Flows for site 380105 were extrapolated based on drainage area from the discharge record at the United States Geological Survey (USGS) gage site (06354000) located near Breien, North Dakota.

A hydrograph or flow duration curve for the Cannonball can be developed by generating a flow frequency table using daily stream flow data over a twenty year period and plotting the points as

a flow duration curve (Figure 7). For purposes of this TMDL low flow is defined as flows which are exceeded 80 percent of the time or flows less than 4 cubic feet per second (cfs). High flows are flows that are exceeded less than 20 percent of the time or flows greater than 80 cfs. Moderate flows are flows between 4 cfs and 80 cfs. Observed in-stream fecal coliform bacteria concentrations from monitoring site 380105 were converted to pollutant loads by multiplying

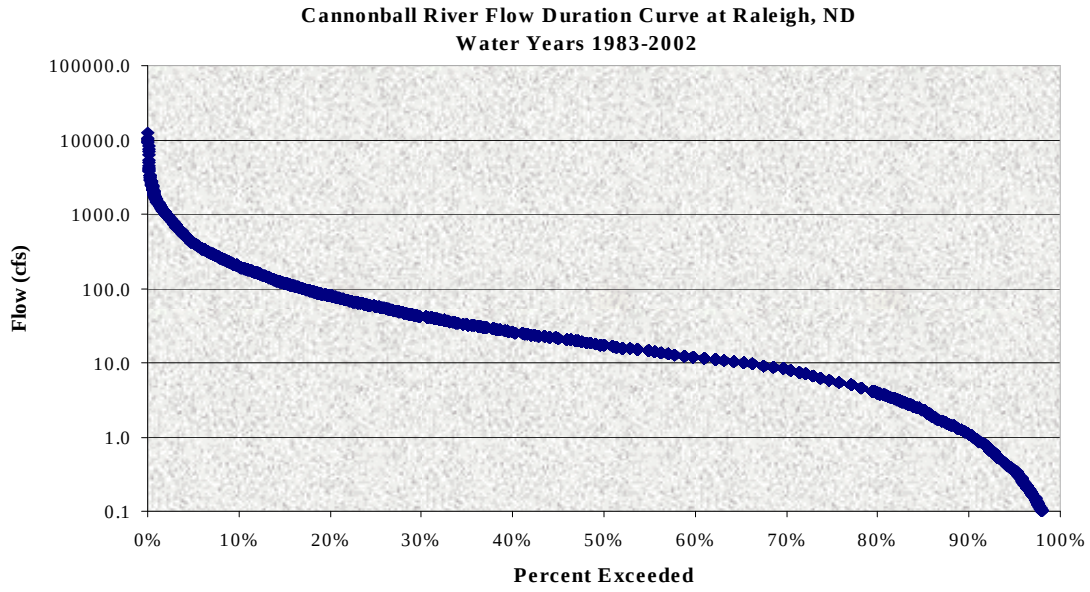

Figure 7. Cannonball River Flow Duration Curve.

concentrations by the flow and a conversion factor. These loads are plotted against the percent exceeded of the flow on the day of sample collection (Figure 9). Points plotted above the 200 CFU/100 mL target curve exceed the water quality target (Figure 9). Points plotted below the curve are meeting the water quality target of 200 CFU/100 mL.

Observed loads plotted on the load duration curve exceeded the target curve in all three flow regimes. Those loads above the target curve in the low flow regime less than 4 cfs indicate direct sources of pollution, such as point sources or livestock located in close proximity to the stream. Since there are no known point sources in the watershed, loading sources exceeding the target curve in the low flow regime are considered to originate from direct deposit of fecal matter by livestock utilizing the river as a water source during low flows. Discharges from failing septic systems are also likely occurring at low flow. Fecal coliform bacteria loads above the target line in the medium flow regime, between 4 cfs and 80 cfs, and those loads greater than 80 cfs in the high flow regime indicate non-point source pollution. Specific non-point sources of pollution and their potential to contribute fecal coliform bacteria loads under high, medium and low flow regimes in the Cannonball River watershed are described in Table 9.

Table 9. Non-Point Sources of Pollution and their Potential to Pollute at a Given Flow Regime.

Non-Point Sources	Flow Regime		
	High Flow	Medium Flow	Low Flow
Riparian Area Grazing (Livestock)	H	H	H
Animal Feeding Operations	H	M	L
Manure Application to Crop and Range Land	H	M	L
Intensive Upland Grazing (Livestock)	H	M	L

Note: Potential importance of non-point source area to contribute fecal coliform bacteria loads under a given flow regime. (H: High; M: Medium; L: Low)

A linear regression was developed for the sample loads above the TMDL target (200 CFU/100 mL) curve and the percent exceeded for site 380105 (Figure 8). The linear regression line for site 380105 was then used with percent exceeded of the flow to calculate existing fecal coliform bacteria loads and the fecal coliform load for each flow regime necessary to reach the TMDL target concentration of 200 CFU/100 mL (Figure 9).

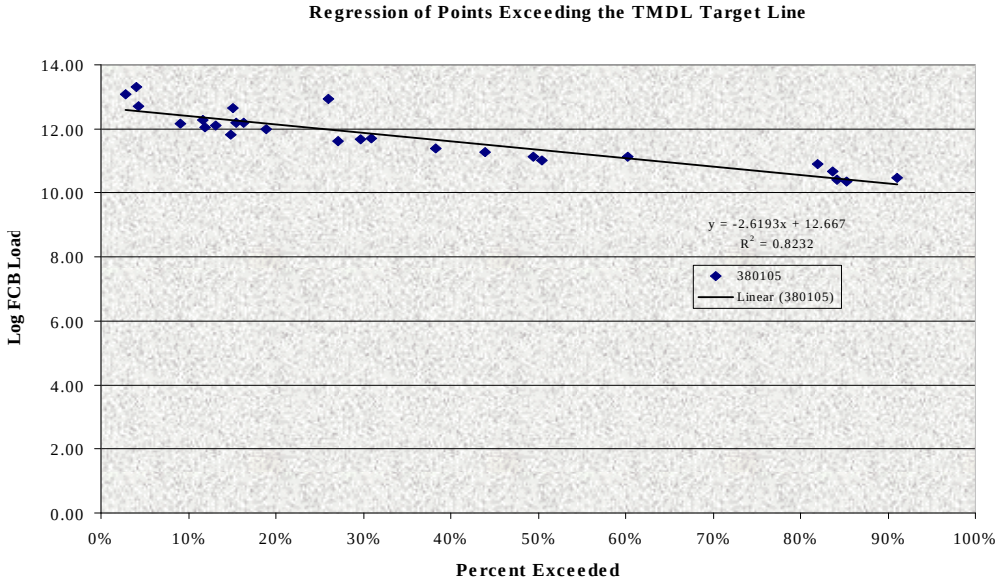

Figure 8. Regression of Points Exceeding the TMDL Target Curve.

For each flow regime, (high, medium, low) the existing load was calculated from the linear regression as the average load of each percent exceeded flow value within the flow regime. For example, for the high flow regime the average existing daily load is calculated from each estimated daily load for the 1st, 2nd, 3rd, 4th..., 20th percent exceeded flow values.

The loading capacity or TMDL for each flow regime is average load needed to meet the TMDL target concentration of 200 CFU/100 mL. For example, the TMDL for the high flow regime is estimated as the average of each percent exceeded flow value (1st, 2nd, 3rd, 4th, ..., 20th) calculated from the load duration curve line (Figure 9).

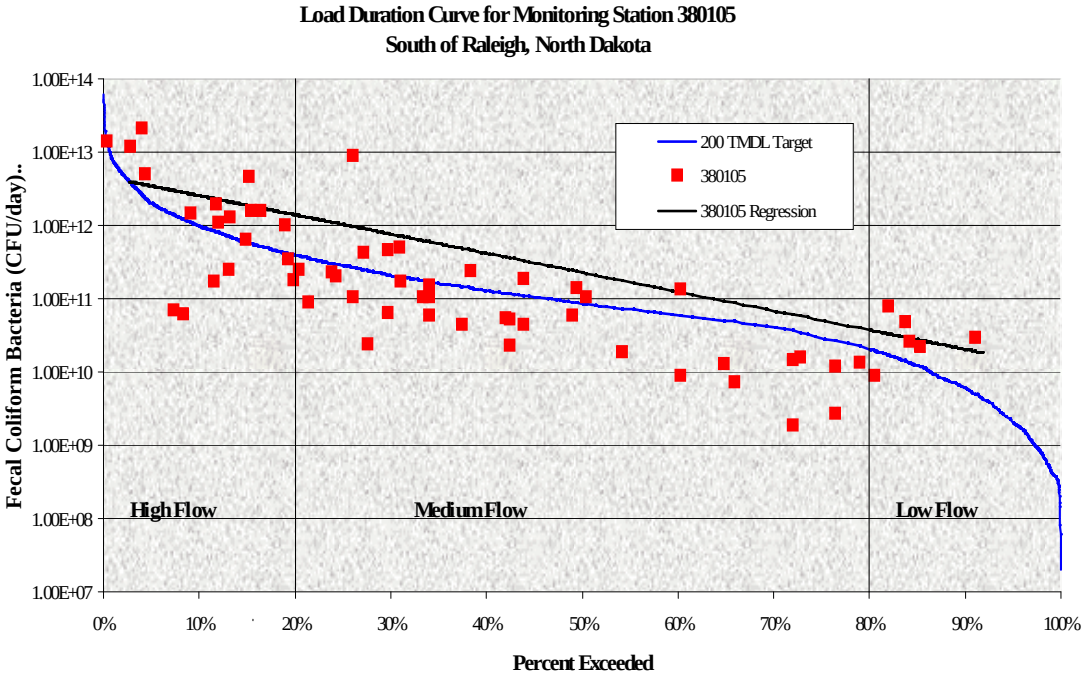

Figure 9. Cannonball River Load Duration Curve at Monitoring Station 380105, South of Raleigh, North Dakota.

One of the more important concerns regarding non-point sources is variability in stream flows. Variable stream flows often cause different source areas and loading mechanisms to dominate (Cleland, 2003). As previously described, three flow regimes were selected to represent the hydrology of the watershed (Figure 9). In southwest North Dakota, rain events are also variable. Rain events can be sporadic and heavy or light, occurring over a short duration. Precipitation events of large magnitude, occurring at a faster rate than absorption, contribute to high runoff events. These events are represented by runoff in the high flow regime. The medium flow

regime is represented by runoff that contributes to the stream over a longer duration and for a longer period of time. The low flow regime is characteristic of drought or precipitation events of small magnitude and do not contribute to runoff. By relating runoff characteristics to each flow regime one can infer which sources are most likely to contribute to fecal coliform loading. Animals grazing in the riparian area contribute fecal coliform bacteria by depositing manure where it has an immediate impact on water quality. Due to the close proximity of manure to the stream or by direct deposition in the stream, riparian grazing impacts water quality at high, medium and low flows (Table 9). In contrast, intensive grazing of livestock in the upland and not in the riparian area has a high potential to impact water quality at high flows, medium impact at moderate flows and a low impact at low flows (Table 9). Exclusion of livestock from the riparian area eliminates the potential of direct manure deposit and therefore is considered to be of high importance at low flows. However, intensive grazing in the upland creates the potential for manure accumulation and availability for runoff at high flows and a high potential for fecal coliform bacteria contamination. Best professional judgement indicates that three flow regimes are adequate in identifying source areas and loading mechanisms.

6.0 MARGIN OF SAFETY AND SEASONALITY

6.1 Margin of Safety

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency EPA's regulations require that "TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." The margin of safety (MOS) can be either incorporated into conservative assumptions used to develop the TMDL (implicit) or added to separate component of the TMDL (explicit).

- To account for the uncertainty associated with known sources and the load reductions necessary to reach the water quality target of 200 CFU/100 mL, a 10 percent explicit margin of safety was used for this TMDL. The MOS was calculated as 10 percent of the TMDL. In other words 10 percent of the TMDL is set aside from both the load allocation and the wasteload allocation as a margin of safety. The 10 percent MOS was derived by taking 10 percent of the TMDL for each flow regime.

6.2 Seasonality

Section 303(d)(1)(C) of the Clean Water Act and associated regulations require that a TMDL be established with seasonal variations. The Cannonball River TMDL addresses seasonality because the flow duration curve was developed using 20 years of USGS gage data encompassing twelve months of the year. Additionally, the water quality standard is seasonally based on the

recreation season from May 1 to September 30 and controls will be designed to reduce coliform loads during the seasons covered by the standard.

7.0 TMDL

Table 10 provides the reader an outline of the critical elements of the Cannonball River TMDL. Table 11 provides a summary of average daily loads necessary to meet the water quality target (i.e. TMDL). This load or TMDL includes a load allocation from known non-point sources, a waste load allocation from known point sources and a 10 percent margin of safety.

Table 10. TMDL Summary for the Cannonball River.

Category	Description	Explanation
Beneficial Use Impaired	Recreation	Contact Recreation (i.e. swimming, fishing)
Pollutant	Fecal Coliform Bacteria	See Section 2.1
TMDL Target	200 CFU/100 mL	Based on North Dakota water quality standards
Significant Sources	Non-Point Sources	No Point Sources in Sub-Watershed
Margin of Safety (MOS)	Explicit	10%

The TMDL can be generically described by the following equation:

TMDL = WLA + LA + MOS

where:

TMDL = Total Maximum Daily Load, or the maximum loading a waterbody can receive without violating water quality standards;

WLA = Wasteload allocation, or the portion of the TMDL allocated to existing or future point sources;

LA = Load allocation, or the portion of the TMDL allocated to existing or future NPS; and

MOS = Margin of safety, or an accounting of uncertainty about the relationship between pollutant loads and receiving water quality. The margin of safety can be provided implicitly through analytical assumptions or explicitly by reserving a portion of the loading capacity

Based on the "load duration curve" analyses (See Section 5), an average daily load (TMDL) of fecal coliform at high flows is estimated to be 1.135E+12 CFU/day (Table 11). At high flows, the margin of safety is 10 percent of the TMDL or 1.135E+11 CFU/day. Since there are no point sources in the watershed all of the remaining load is allocated to nonpoint sources. The load allocation is therefore the difference between the TMDL and the 10 percent margin of safety or

1.022E+12 CFU/day. To meet the water quality standard of 200 CFU/100 mL at medium and low flows, the average daily load allocation is 1.192E+11 and 1.197E+10 CFU/day, respectively. At medium flows the margin of safety is 10 percent of the TMDL or 1.192E+10 CFU/day and at low flows the margin of safety is 1.197E+09 CFU/day. At medium and low flows all of the remaining load is also allocated to nonpoint sources, therefore the load allocation is the difference between the TMDL and the 10 percent margin of safety or 1.073E+11 CFU/day for medium flows and 1.077E+10 CFU/day for low flows (Table 11).

Future monitoring to determine compliance with loads listed in Table 11 is dependent upon financial support and available staff. While limited to 8-9 samples per year, ambient monitoring will be continued at Station 380105 south of Raleigh. Implementation of BMPs necessary to achieve the TMDL will be accomplished through the Environmental Quality Incentive Program (EQIP) and/or the 319 Non-point Source Pollution Management Program (319). If 319 is used for implementation, monitoring will be included as a component of the project to document BMP effectiveness. If EQIP is used, NRCS has no requirements to monitor to document program effectiveness.

Table 11. Fecal Coliform Bacteria Loads for Cannonball River at Site 380105.

Loads Expressed as Average CFU/day			
Flow Regime	High Flow	Medium Flow	Low Flow
Existing Load	2.452E+12	3.768E+11	2.743E+10
TMDL	1.135E+12	1.192E+11	1.197E+10
WLA	0.000E+0	0.000E+0	0.000E+0
LA	1.022E+12	1.073E+11	1.077E+10
MOS	1.135E+11	1.192E+10	1.197E+09

8.0 ALLOCATION

All of the nonpoint source load is allocated as a single load because there is not enough detailed source data to allocate the load to individual uses (e.g., animal feeding, septic systems, riparian grazing, upland grazing). Because there are no known point sources, all of the fecal coliform load for this TMDL was allocated to nonpoint sources in the watershed. To achieve the TMDL targets identified in the report will require the wide spread support and voluntary participation of landowners and residents in the immediate watershed as well as those living upstream. The TMDL's described in this report are a plan to improve water quality by implementing best management practices through non-regulatory approaches. "Best management practices" (BMPs) are methods, measures, or practices that are determined to be a reasonable and cost effective means for a land owner to meet non-point source pollution control needs," (USEPA, 2001). This

TMDL plan is put forth as recommendations for what needs to be accomplished for the Cannonball River and its watershed from its confluence at Snake Creek downstream to its confluence with Cedar Creek to restore and maintain its recreational uses. It is recommended that as BMPs are implemented to achieve these TMDL targets, water quality monitoring should also be implemented to measure BMP effectiveness and to determine through adaptive management if loading allocation recommendations need to be adjusted.

Non-point source pollution is the sole contributor to elevated fecal coliform bacteria levels in the Cannonball River, no point source pollution sources are located within the watershed. Three flow regimes (high flows, medium flows, low flows) have been identified for the TMDL. Each flow regime has the capacity to deliver pollutant loads from different sources in the watershed at varying magnitudes. To reduce NPS pollution for each flow regime, specific BMPs are described that will mitigate the affects of fecal coliform loading to the impaired reach. Table 12 illustrates specific BMPs that, when implemented in the watershed and based on specific hydrologic conditions, will result in reducing fecal coliform loading necessary to meet the water quality target.

Table 12. Management Practices and Flow Regimes Affected by Implementation.

Management Practice	Flow Regime and Expected Reduction		
	High Flow 58%	Medium Flow 71%	Low Flow 60%
Livestock Exclusion From Riparian Area	✓	✓	✓
Water Well & Tank Development	✓	✓	✓
Prescribed Grazing	✓	✓	✓
Waste Management System	✓	✓	
Vegetative Filter Strip		✓	
Septic System Repair		✓	✓

Note: ✓ Denotes potential of management practice to contribute to reduction needed under defined flow regime.

Controlling non-point sources is an immense undertaking requiring extensive financial and technical support. Provided that technical and financial assistance is available to stakeholders, these BMPs have the potential to significantly reduce fecal coliform loads to the Cannonball River. The following describe in detail those BMPs listed in Table 12 that will reduce fecal coliform bacteria levels in the Cannonball River.

8.1 Livestock Management Recommendations

Livestock management BMPs are designed to promote healthy water quality and riparian areas through management of livestock and associated grazing land. Fecal matter from livestock and erosion from poorly managed grazing land and riparian areas can be a significant source of fecal coliform bacteria loading to surface water. Precipitation, plant cover, number of animals, and soils are factors that affect the amount of bacteria delivered to a waterbody as a result of livestock. These specific BMPs are known to reduce NPS pollution from livestock. They are:

Livestock exclusion from riparian areas - This practice is established to remove livestock from grazing riparian areas and watering in the stream. Livestock exclusion is accomplished through fencing. A reduction in stream bank erosion can be expected by minimizing or eliminating hoof trampling. A stable stream bank will support vegetation that will hold banks in place and serve a secondary function as a filter from non-point source runoff. Added vegetation will create aquatic habitat and shading for macroinvertebrates and fish. Direct deposit of fecal matter into the stream and stream banks will be eliminated as a result of livestock exclusion by fencing.

Water well and tank development - Fencing animals from stream access requires an alternative water source, installing water wells and tanks satisfies this need. Installing water tanks provides a quality water source and keeps animals from wading and defecating in streams. This will reduce the probability of pathogenic infections to livestock and the environment.

Prescribed grazing - To increase ground cover and ground stability by rotating livestock throughout multiple fields. Grazing with a specified rotation minimizes overgrazing and resulting erosion. The Natural Resources Conservation Service (NRCS) recommends grazing systems to improve and maintain water quality and quantity. Duration, intensity, frequency, and season of grazing can be managed to enhance vegetation cover and litter, resulting in reduced runoff, improved infiltration, increased quantity of soil water for plant growth, and better manure distribution and increased rate of decomposition, (NRCS, 1998).

In a study by Tiedemann et al. (1988), as presented by USEPA, (1993), the effects of four grazing strategies on bacteria levels in thirteen watersheds in Oregon were studied during the summer of 1984. Results of the study (Table 13) showed that when livestock are managed at a stocking rate of 19 acres per animal unit month with water developments and fencing, bacteria levels were reduced significantly.

Waste management system - Waste management systems can be effective in controlling up to 90 percent of fecal coliform loading originating from confined animal feeding areas

(Table 14). A waste management system is made up of various components designed to control NPS pollution from concentrated animal feeding operations (CAFOs) and animal feeding operations (AFOs). Diverting clean water from the feeding area and containing dirty water from the feeding area in a pond are typical practices of a waste management system. Manure handling and application procedures are also integral to the waste management system. The application of manure is designed to be adaptive to environmental, soil, and plant conditions to minimize the probability of contamination of surface water.

Table 13. Bacterial Water Quality Response to Four Grazing Strategies (Tiedemann et al., 1988).

Practice	Geometric Mean Fecal Coliform Count
Strategy A: Ungrazed	40/L
Strategy B: Grazing without management for livestock distribution; 20.3 ac/AUM.	150/L
Strategy C: Grazing with management for livestock distribution: fencing and water developments; 19.0 ac/AUM.	90/L
Strategy D: Intensive grazing management, including practices to attain uniform livestock distribution and improve forage production with cultural practices such as seeding, fertilizing, and forest thinning; 6.9 ac/AUM.	920/L

8.2 Other recommendations

Vegetative filter strip - Vegetated filter strips are used to reduce the amount of sediment, particulate organics, dissolved contaminants, nutrients, and in the case of this TMDL, fecal coliform bacteria to streams. The effectiveness of filter strips and other BMPs in removing fecal coliform bacteria is quite successful. Results from a study by Pennsylvania State University (1992a) as presented by USEPA (1993) (Table 14), suggest that vegetative filter strips are capable of removing up to 55 percent of fecal coliform loading to rivers and streams (Table 14). The ability of the filter strip to remove contaminants is dependent on field slope, filter strip slope, erosion rate, amount and particulate size distribution of sediment delivered to the filter strip, density and height of vegetation, and runoff volume associated with erosion producing events (NRCS 2001).

Septic Systems - Septic systems provide an economically feasible way of disposing of household wastes where other means of waste treatment are unavailable (e.g., public or private treatment facilities). The basis for most septic systems involves the treatment and distribution of household wastes through a series of steps involving the following:

1. A sewer line connecting the house to a septic tank
2. A septic tank that allows solids to settle out of the effluent
3. A distribution system that dispenses the effluent to a leach field
4. A leaching system that allows the effluent to enter the soil

Table 14. Relative Gross Effectiveness[a] of Confined Livestock Control Measures (Pennsylvania State University, 1992a).

Practice[b] Category	Runoff[c] Volume	Total[d] Phosphorus (%)	Total[d] Nitrogen (%)	Sediment (%)	Fecal Coliform (%)
Animal Waste System[e]	-	90	80	60	85
Diversion Systems[f]	-	70	45	NA	NA
Filter Strips[g]	-	85	NA	60	55
Terrace System	-	85	55	80	NA
Containment Structures[h]	-	60	65	70	90

NA = not available.
a Actual effectiveness depends on site-specific conditions. Values are not cumulative between practice categories.
b Each category includes several specific types of practices.
c - = reduction; + = increase; 0 = no change in surface runoff
d Total phosphorus includes total and dissolved phosphorus; total nitrogen includes organic-N, ammonia-N, and nitrate-N
e Includes methods for collecting, storing, and disposing of runoff and process-generated wastewater.
f Specific practices include diversion of uncontaminated water from confinement facilities.
g Includes all practices that reduce contaminant losses using vegetative control measures.
h Includes such practices as waste storage ponds, waste storage structures, waste treatment lagoons.

Septic system failure occurs when one or more components of the septic system do not work properly and untreated waste or wastewater leaves the system. The waste may pond in the leach field and ultimately run off directly into nearby streams or percolate into groundwater. Untreated septic system waste is a potential source of nutrients (nitrogen and phosphorus), organic matter, suspended solids, and fecal coliform bacteria. Results from DNA fingerprinting of E. coli indicate two of the three monitoring stations on the Cannonball River contained E. coli of human origin (Tables 7 and 8). Failing septic systems are the most likely source of human E. coli in the Cannonball River. Land application of septic system sludge, although unlikely, may also be a source of contamination.

Septic system failure can occur for several reasons, the most common reason is improper maintenance (e.g. age, inadequate pumping). Other reasons for failure include improper installation, location, and choice of system. Harmful household chemicals can also cause failure by killing the bacteria that digest the waste.

Results from "DNA Fingerprinting" analysis indicates that loads from onsite wastewater treatment systems are a potential source of bacteria in the Cannonball River watershed. While the number of systems that are not functioning properly is unknown, it is estimated that 28 percent of the systems in North Dakota are failing (USEPA, 2002). Based on the age of most residences in the Cannonball River watershed, it is reasonable to assume that this rate is even higher in the Cannonball River watershed.

9.0 PUBLIC PARTICIPATION

To satisfy the public participation requirement of this TMDL, a hard copy of the TMDL for the Cannonball River and a request for comment was mailed to participating agencies, partners, and to those who requested a copy. Those included in the mailing of a hard copy were as follows:

- Grant County Soil Conservation District
- Grant County Water Resource Board
- Natural Resources Conservation Service
- Environmental Protection Agency
- U.S. Fish & Wildlife Service

In addition to mailing copies of this TMDL for the Cannonball River to interested parties, the TMDL was posted on the North Dakota Department of Health, Division of Water Quality web site at http://www.health.state.nd.us/wq/sw/B_Main.htm. A 30 day public notice soliciting comment and participation was also published in the following newspapers:

- Carson Press, Published February 23, 2005
- Grant County News, Published February 23, 2005
- Bismarck Tribune, Published February 21, 2005

A meeting was held with stakeholders and those who will be involved with implementation of the TMDL. Those stakeholders attending the meeting were Grant County Soil Conservation District staff and board members, the Grant County Water Resource Board Chairperson and the District Conservationist from the Natural Resources Conservation Services Grant County Field Office. One set of comments were received during the comment period which started February 21, 2005 and ended March 24, 2005. These were received from Vern Berry, TMDL Coordinator/Project Officer with US EPA Region VIII. Mr. Berry's comments and the Departments response to his comments are provided in Appendix A.

10.0 ENDANGERED SPECIES ACT COMPLIANCE

States are encouraged to participate with the U.S. Fish and Wildlife Service and EPA in documenting threatened and endangered species on the Endangered Species List. In an effort to assist in Endangered Species Act compliance, a request for a list of endangered and/or threatened species was made to the U.S. Fish and Wildlife Service (Figure 10). A hard copy of the draft TMDL report will also be sent to the U.S. Fish and Wildlife Services Bismarck, North Dakota office for review. The following is a list of threatened or endangered species specific to the Cannonball River and Grant County:

Whooping Crane (Grus americana), Endangered
Black-Footed Ferret (Mustela nigripes), Endangered
Bald Eagle (Haliaeetus leucocephalus), Threatened

U.S. FISH & WILDLIFE SERVICE
3425 MIRIAM AVENUE
BISMARCK ND 58501

Received 12-13-04

OFFICE TRANSMITTAL

TO: Mark A. Glaser
ND Department of Health
Dickinson, ND

☐ ACTION
☑ INFORMATION

FROM: Kevin Johnson DIVISION: Ecological Services DATE: 12-8-04

Information you requested.

FEDERAL THREATENED AND ENDANGERED SPECIES
AND DESIGNATED CRITICAL HABITAT FOUND IN
GRANT, MORTON, AND SIOUX COUNTIES, NORTH DAKOTA

ENDANGERED SPECIES

Birds

Interior least tern (Sterna antillarum): Nests along midstream sandbars of the Missouri and Yellowstone Rivers. (Morton and Sioux counties)

Whooping crane (Grus Americana): Migrates through west and central counties during spring and fall. Prefers to roost on wetlands and stockdams with good visibility. Young adult summered in North Dakota in 1989, 1990, and 1993. Total population 140-150 birds. (Grant, Morton, and Sioux counties)

Fish

Pallid sturgeon (Scaphirhynchus albus): Known only from the Missouri and Yellowstone Rivers. No reproduction has been documented in 15 years. (Morton and Sioux counties)

Mammals

Black-footed ferret (Mustela nigripes): Exclusively associated with prairie dog towns. No records of occurrence in recent years, although there is potential for reintroduction in the future. (Grant, Morton and Sioux counties)

THREATENED SPECIES

Birds

Bald eagle (Haliaeetus leucocephalus): Migrates spring and fall statewide but primarily along the major river courses. It concentrates along the Missouri River during winter and is known to nest in the floodplain forest. (Grant, Morton and Sioux counties)

Piping plover (Charadrius melodus): Nests on midstream sandbars of the Missouri and Yellowstone Rivers and along shorelines of saline wetlands. More nest in North Dakota than any other state. (Morton and Sioux counties)

Figure 10. Office Transmittal and Threatened and Endangered Species List

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ACKNOWLEDGMENTS

A host of resources and professionals were utilized in the development of this TMDL. In particular, thank you to James Meek, Environmental Scientist, for assistance with technical analysis and load duration curve development. Thank you to Michael J. Ell, Environmental Administrator and Program Manager, for review and comment.

APPENDIX A.

EPA Comments from the Public Notice Period
and the
States Response

EPA Region VIII TMDL Review Form

Document Name:	Cannonball River - Bacteria TMDL
Submitted By:	Mike Ell, NDDH
Date Received:	February 9, 2005
Review Date:	March 7, 2005
Reviewer:	Vern Berry, EPA
Formal or Informal Review?	Informal - Public Notice

This document provides a standard format for EPA Region VIII to provide comments to the North Dakota Department of Health on TMDL documents provided to the EPA for either official formal, or informal review. All TMDL documents are measured against the following 12 review criteria:

1. Water Quality Impairment Status
2. Water Quality Standards
3. Water Quality Targets
4. Significant Sources
5. Technical Analysis
6. Margin of Safety and Seasonality
7. Total Maximum Daily Load
8. Allocation
9. Public Participation
10. Monitoring Strategy
11. Restoration Strategy
12. Endangered Species Act Compliance

Each of the 12 review criteria are described below to provide the rational for the review, followed by EPA's comments. This review is intended to ensure compliance with the Clean Water Act and also to ensure that the reviewed documents are technically sound and the conclusions are technically defensible. This document review form incorporates by reference the Region VIII TMDL review criteria (see Region VIII's annotated criteria).

1. Water Quality Impairment Status

Criterion Description – Water Quality Impairment Status

TMDL documents must include a description of the listed water quality impairments. While the 303(d) list identifies probable causes and sources of water quality impairments, the information contained in the 303(d) list is generally not sufficiently detailed to provide the reader with an adequate understanding of the impairments. TMDL documents should include a thorough description/summary of all available water quality data such that the water quality impairments are clearly defined and linked to the impaired beneficial uses and/or appropriate water quality standards

✔Satisfies Criterion

☐ Satisfies Criterion. Questions or comments provided below should be considered.

☐ Partially satisfies criterion. Questions or comments provided below need to be addressed.

☐ Criterion not satisfied. Questions or comments provided below need to be addressed.

☐ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - The Cannonball River flows through five counties in southwest North Dakota. The Cannonball River is part of the Missouri River Basin and flows into Lake Oahe near the town of Cannon Ball. The segment covered by this TMDL is described on the State's 2004 303(d) list as the segment from the River's confluence with Snake Creek downstream to its confluence with Cedar Creek in Grant County, North Dakota. The length of this segment is 34.16 miles. The impaired use and pollutant is recreation for total fecal coliform bacteria respectively. Approximately 110,403 acres of land drain to this segment of the Cannonball River. It is a Class II stream and is listed as a high priority for TMDL development. The majority of the land use in this sub-watershed is pasture and rangeland

2. Water Quality Standards

Criterion Description – Water Quality Standards

The TMDL document must include a description of all applicable water quality standards for all affected jurisdictions. TMDLs result in maintaining and attaining water quality standards. Water quality standards are the basis from which TMDL's are established and the TMDL targets are derived, including the numeric, narrative, use classification, and antidegradation components of the standards.

✔ Satisfies Criterion

□ Satisfies Criterion. Questions or comments provided below should be considered.

□ Partially satisfies criterion. Questions or comments provided below need to be addressed.

□ Criterion not satisfied. Questions or comments provided below need to be addressed.

□ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - The Cannonball River is not meeting its designated use for recreation due to total fecal coliform bacteria levels that exceed the State water quality standard. The fecal coliform standard applicable to the Cannonball River is 200 colony-forming units (CFU) per 100 mL. This standard only applies during the recreation season from May 1st to September 30th. State narrative standards are also applicable and are discussed in Section 2.1 of the TMDL.

3. Water Quality Targets

Criterion Description – Water Quality Targets

Quantified targets or endpoints must be provided to address each listed pollutant/water body combination. Target values must represent achievement of applicable water quality standards and support of associated beneficial uses. For pollutants with numeric water quality standards, the numeric criteria are generally used as the TMDL target. For pollutants with narrative standards, the narrative standard must be translated into a measurable value. At a minimum, one target is required for each pollutant/water body combination. It is generally desirable, however, to include several targets that represent achievement of the standard and support of beneficial uses (e.g., for a sediment impairment issue it may be appropriate to include targets representing water column sediment such as TSS, embeddeness, stream morphology, up-slope conditions, and a measure of biota).

Satisfies Criterion

✔ Satisfies Criterion. Questions or comments provided below should be considered.
□ Partially satisfies criterion. Questions or comments provided below need to be addressed.
□ Criterion not satisfied. Questions or comments provided below need to be addressed.
□ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - The water quality target for the segment of the Cannonball River covered by this TMDL is 200 fecal coliforms per 100 mL. This target is based on NDDH's fecal coliform standard for Class II waters to protect recreational uses.

4. Significant Sources

Criterion Description – Significant Sources

TMDLs must consider all significant sources of the stressor of concern. All sources or causes of the stressor must be identified or accounted for in some manner. The detail provided in the source assessment step drives the rigor of the allocation step. In other words, it is only possible to specifically allocate quantifiable loads or load reductions to each significant source when the relative load contribution from each source has been estimated. Ideally, therefore, the pollutant load from each significant source should be quantified. This can be accomplished using site-specific monitoring data, modeling, or application of other assessment techniques. If insufficient time or resources are available to accomplish this step, a phased/adaptive management approach can be employed so long as the approach is clearly defined in the document.

✔ Satisfies Criterion
□ Satisfies Criterion. Questions or comments provided below should be considered.
□ Partially satisfies criterion. Questions or comments provided below need to be addressed.
□ Criterion not satisfied. Questions or comments provided below need to be addressed.
□ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - The Cannonball River TMDL is a nonpoint source TMDL. There are no known point sources in this segment of the river. The largest contributor of fecal coliform bacteria to this segment of the Cannonball River is various agricultural nonpoint sources. The majority of the land use in the sub-watershed covered by this TMDL is pasture and rangeland. Cropland, CRP, farmstead and other non-crop uses makeup the remainder of the land use in this sub-watershed.

Two samples from each monitoring station were analyzed using DNA fingerprinting (i.e., bacteria source tracking) of E. coli to determine if the sources were human or non-human. Both human and animal sources were found in the samples, however, of the 27 isolates, most were found to be animal sources (only 5 of the 27 were determined to be human sources). Animal feeding areas and livestock grazing are likely contributors. Human sources are likely to be from failing septic systems or direct discharge sewage systems.

5. Technical Analysis

Criterion Description – Technical Analysis

*TMDLs must be supported by an appropriate level of technical analysis. It applies to **all** of the components of a TMDL document. It is vitally important that the technical basis for **all** conclusions be articulated in a manner that is easily understandable and readily apparent to the reader. Of particular importance, the cause and effect relationship between the pollutant and impairment and between the selected targets, sources, TMDLs, and allocations needs to be supported by an appropriate level of technical analysis.*

□ Satisfies Criterion
✔ Satisfies Criterion. Questions or comments provided below should be considered.
□ Partially satisfies criterion. Questions or comments provided below need to be addressed.
□ Criterion not satisfied. Questions or comments provided below need to be addressed.
□ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - The technical analysis addresses the fecal coliform reductions necessary to achieve the water quality standard. The TMDL recommends fecal coliform reductions that vary depending on the flow in the river (i.e., high, medium or low). The reduction in fecal coliform loading from nonpoint sources is 58% at higher flows, 71% at medium flows, and 44% at lower flows. The TMDL uses a load duration curve to determine the cause and effect relationship between the water quality target and the identified sources. The flow duration curve was developed for monitoring station 380105 near the downstream end of the listed segment. The flow data for this point was extrapolated using the hydrologic record from a USGS station located near Breien, North Dakota.

COMMENTS - The use of regression line drawn across the exceedances at all flow regimes (across the entire curve) may be appropriate for this stream segment (i.e., the points above the line at the upper end of the curve are about the same distance from the curve as they are at the lower end of the curve). However, this approach may not be appropriate for other stream segments in the state. There are other options for determining the best fit for the exceedances. Generally, a regression line or some other technique is fit to the exceedances in each flow regime separately. Future TMDLs that use load duration curves should consider other options.

STATES RESPONSE - Comments from EPA regarding the use of a regression line for each flow regime rather than across the exceedances of all flow regimes to calculate the TMDL was taken into consideration and implemented. Section 5.0 of the Cannonball River Bacteria TMDL explains the States methodology in calculating the TMDL for the Cannonball River using a linear regression line for each flow regime.

6. Margin of Safety and Seasonality

Criterion Description – Margin of Safety/Seasonality

A margin of safety (MOS) is a required component of the TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water body (303(d)(1)(c)). The MOS can be implicitly expressed by incorporating a margin of safety into conservative assumptions used to develop the TMDL. In other cases, the MOS can be built in as a separate component of the TMDL (in this case, quantitatively, a TMDL = WLA + LA + MOS). In all cases, specific documentation describing the rational for the MOS is required.

Seasonal considerations, such as critical flow periods (high flow, low flow), also need to be considered when establishing TMDLs, targets, and allocations.

□ Satisfies Criterion
✔ Satisfies Criterion. Questions or comments provided below should be considered.
□ Partially satisfies criterion. Questions or comments provided below need to be addressed.
□ Criterion not satisfied. Questions or comments provided below need to be addressed.
□ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - An appropriate margin of safety is included in the TMDL as a 10% explicit margin of safety that is applied to the water quality standard. Seasonality was adequately considered through the use of the flow duration curve which was developed with 20 years of flow data that covers all twelve months of the year. Also, the water quality standard is seasonally based (i.e, May 1st to September 30th), and controls will be designed to reduce coliform loads during the seasons covered by the standard.

COMMENTS - The 10% explicit MOS was derived by taking the difference between the points on the load duration curve using the 200 cfu/100ml standard and the curve using the 180 cfu/100ml (i.e., in the spreadsheet the MOS values are the column "F" values minus the column "G" values). This is an acceptable approach, however it's not well explained in the MOS section (6.1). Please provide an explanation of how the MOS was derived.

STATES RESPONSE - Taking into consideration EPA comments and their request for an explanation of how the MOS was derived, the State further explained its rationale in how the MOS was calculated in Section 6.1 of the Cannonball River Bacteria TMDL.

7. TMDL

Criterion Description – Total Maximum Daily Load

TMDLs include a quantified pollutant reduction target. According to EPA reg (see 40 CFR 130.2(i)) TMDLs can be expressed as mass per unit of time, toxicity, % load reduction, or other measure. TMDLs must address, either singly or in combination, each listed pollutant/water body combination.

✔ Satisfies Criterion
□ Satisfies Criterion. Questions or comments provided below should be considered.
□ Partially satisfies criterion. Questions or comments provided below need to be addressed.
□ Criterion not satisfied. Questions or comments provided below need to be addressed.
□ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - The TMDL established for the Cannonball River is expressed as fecal coliform loads (i.e., average # CFU/day) to the River. The TMDL loads are provided for three major flow regimes shown on the load duration curve which represent high, medium and low flows (see Table 11). The range of fecal coliform load reduction that is necessary from nonpoint sources to achieve the water quality standard is 58-71% (including a MOS). The actual loading will vary from year-to-year, therefore this TMDL is considered a long term average percent reduction in fecal coliform loading to the River.

8. Allocation

Criterion Description – Allocation

TMDLs apportion responsibility for taking actions or allocate the available assimilative capacity among the various point, nonpoint, and natural pollutant sources. Allocations may be expressed in a variety of ways such as by individual discharger, by tributary watershed, by source or land use category, by land parcel, or other appropriate scale or dividing of responsibility. A performance based allocation approach, where a detailed strategy is articulated for the application of BMPs, may also be appropriate for non point sources.

In cases where there is substantial uncertainty regarding the linkage between the proposed allocations and achievement of water quality standards, it may be necessary to employ a phased or adaptive management approach (e.g., establish a monitoring plan to determine if the proposed allocations are, in fact, leading to the desired water quality improvements).

Allocating load reductions to specific sources is generally the most contentious and politically sensitive component of the TMDL process. It is also the step in the process where management direction is provided to actually achieve the desired load reductions. In many ways, it is a prioritization of restoration activities that need to occur to restore water quality. For these reasons, every effort should be made to be as detailed as possible and also, to base all conclusions on the best available scientific principles.

✔ Satisfies Criterion
□ Satisfies Criterion. Questions or comments provided below should be considered.
□ Partially satisfies criterion. Questions or comments provided below need to be addressed.
□ Criterion not satisfied. Questions or comments provided below need to be addressed.
□ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - This TMDL addresses the reductions in fecal coliform bacteria that are necessary to attain water quality standards in the Cannonball River. The allocation for the TMDL is a "load allocation" attributed to nonpoint sources. There are no known point sources in this segment of the river. The source allocation for fecal coliform is primarily attributed to runoff from pastureland, animal feeding operations, and failing septic systems. There is a desire to move forward with controls in the areas of the basin where there is confidence that fecal coliform reductions can be achieved through modifications to existing practices. Section 8.0 of the TMDL outlines various BMPs that are proposed to be implemented on a voluntary basis by working with landowners in the watershed. The BMPs include excluding livestock from riparian areas, building animal waste management systems and repairing septic systems.

9. Public Participation

Criterion Description – Public Participation

The fundamental requirement for public participation is that all stakeholders have an opportunity to be part of the process. Notifications or solicitations for comments regarding the TMDL should clearly identify the product as a TMDL and the fact that it will be submitted to EPA for review. When the final TMDL is submitted to EPA for review, a copy of the comments received by the state should be also submitted to EPA.

□ Satisfies Criterion
✔ Satisfies Criterion. Questions or comments provided below should be considered.
□ Partially satisfies criterion. Questions or comments provided below need to be addressed.
□ Criterion not satisfied. Questions or comments provided below need to be addressed.
□ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - The TMDL includes a summary of the public participation process that has occurred, and describes the opportunities the public had to be involved in the TMDL development process. Specifically, copies of the draft TMDL were mailed to stakeholders in the watershed for comment, the draft TMDL was posted on NDDH's Water Quality Division website, and a public notice for comment was published in three newspapers in the state.

COMMENTS - The final TMDL needs to include a summary of the comments received during the public notice, and the State's response to the comments, as well as the dates of the start and end of the public notice.

STATES RESPONSE - Start and end dates were added to the Cannonball River TMDL in Section 9.0 per EPA comments. One set of comments were received from Vern Berry, TMDL Coordinator/Project Officer with US EPA Region VIII. Those comments and the States response are included in Appendix A of the Cannonball Bacteria TMDL.

10.0 Monitoring Strategy

Criterion Description – Monitoring Strategy

TMDL's may have significant uncertainty associated with selection of appropriate numeric targets and estimates of source loadings and assimilative capacity. In these cases, a phased TMDL approach may be necessary. For Phased TMDLs, it is EPA's expectation that a monitoring plan will be included as a component of the TMDL documents to articulate the means by which the TMDL will be evaluated in the field, and to provide supplemental data in the future to address any uncertainties that may exist when the document is prepared.

At a minimum, the monitoring strategy should:
- *Articulate the monitoring hypothesis and explain how the monitoring plan will test it;*
- *Address the relationships between the monitoring plan and the various components of the TMDL (targets, sources, allocations, etc.);*
- *Explain any assumptions used;*
- *Describe monitoring methods; and*
- *Define monitoring locations and frequencies, and list the responsible parties*

□ Satisfies Criterion
□ Satisfies Criterion. Questions or comments provided below should be considered.
□ Partially satisfies criterion. Questions or comments provided below need to be addressed.
□ Criterion not satisfied. Questions or comments provided below need to be addressed.
✔ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - The document mentions that monitoring should be conducted to measure BMP effectiveness and to determine whether the goals of the TMDL are being met.

11. Restoration Strategy

Criterion Description – Restoration Strategy

At a minimum, sufficient information should be provided in the TMDL document to demonstrate that if the TMDL were implemented, water quality standards would be attained or maintained. Adding additional detail regarding the proposed approach for the restoration of water quality <u>is not</u> currently a regulatory requirement, but is considered a value added component of a TMDL document.

□ Satisfies Criterion
□ Satisfies Criterion. Questions or comments provided below should be considered.
□ Partially satisfies criterion. Questions or comments provided below need to be addressed.
□ Criterion not satisfied. Questions or comments provided below need to be addressed.
✔ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - The North Dakota Department of Health is working with the local conservation district to develop a plan for a restoration project in the watershed.

12. Endangered Species Act Compliance

Criterion Description – Endangered Species Act Compliance

EPA's approval of a TMDL may constitute an action subject to the provisions of Section 7 of the Endangered Species Act ("ESA"). EPA will consult, as appropriate, with the US Fish and Wildlife Service (USFWS) to determine if there is an effect on listed endangered and threatened species pertaining to EPA's approval of the TMDL. The responsibility to consult with the USFWS lies with EPA and is not a requirement under the Clean Water Act for approving TMDLs. States are encouraged, however, to participate with USFWS and EPA in the consultation process and, most importantly, to document in its TMDLs the potential effects (adverse or beneficial) the TMDL may have on listed as well as candidate and proposed species under the ESA.

□ Satisfies Criterion
□ Satisfies Criterion. Questions or comments provided below should be considered.
□ Partially satisfies criterion. Questions or comments provided below need to be addressed.
□ Criterion not satisfied. Questions or comments provided below need to be addressed.
✔ Not a required element in this case. Comments or questions provided for informational purposes.

SUMMARY - EPA will request ESA Section 7 concurrence from the USFWS for this TMDL.

13. Miscellaneous Comments / Questions

Appendix #2

Grant County Maps

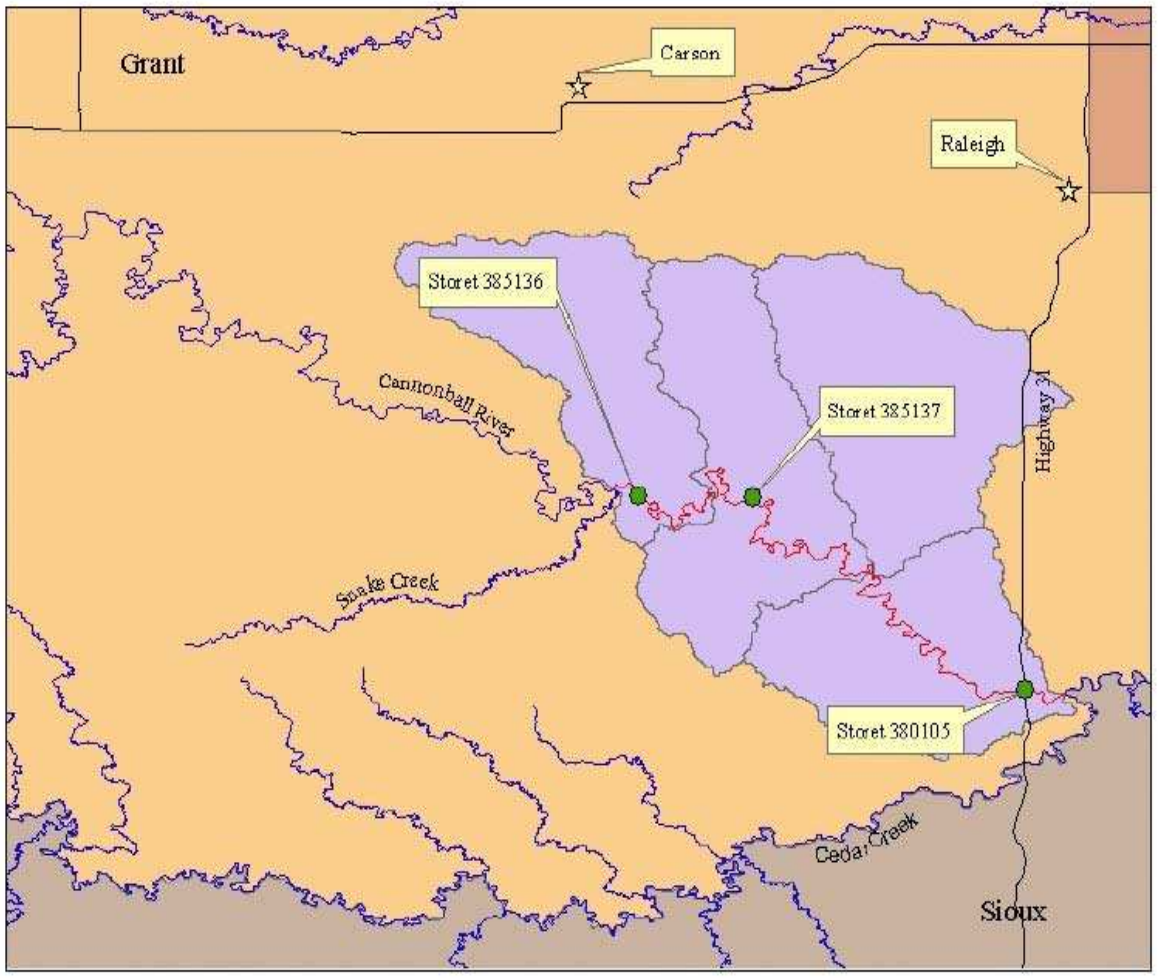
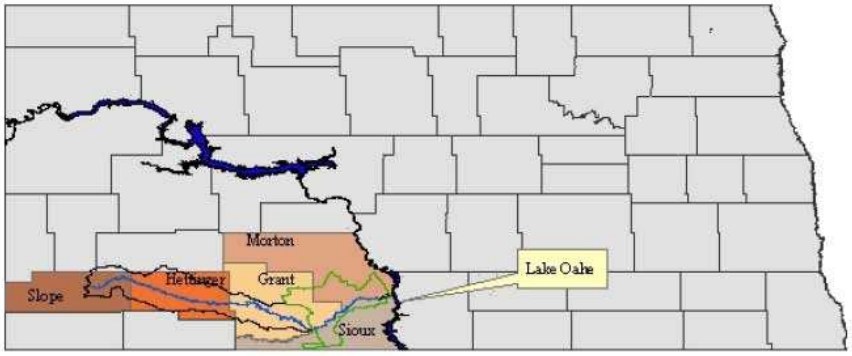


Figure 6. Cannonball River Monitoring Stations



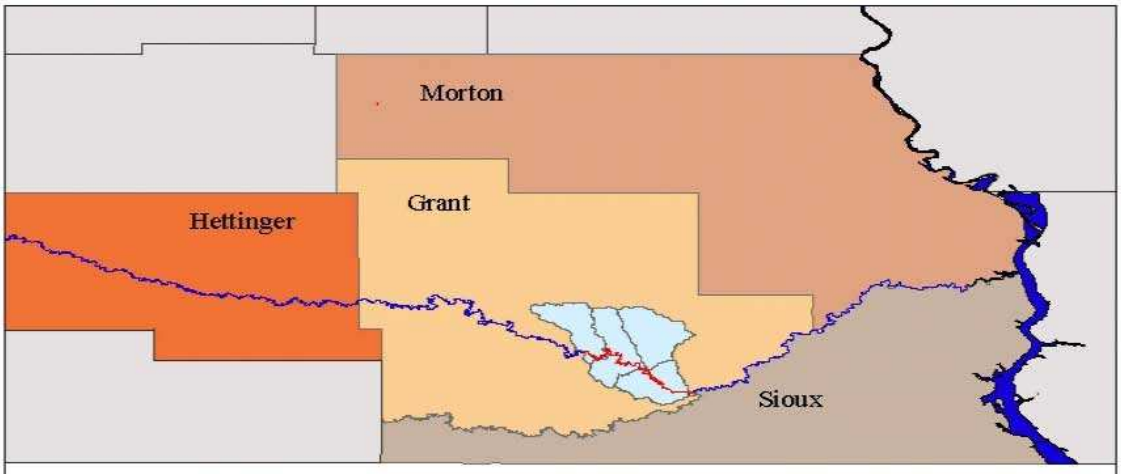
Legend

Lower Cannonball River HUC 10130206

Upper Cannonball River HUC 10130204

Cannonball River

Figure 1. Cannonball River in North Dakota



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Cannonball River TMDL Segment

Cannonball River

Cannonball River TMDL Sub-Watersheds

N

Figure 2. Location of the Cannonball River TMDL Listed Segment and its watersheds

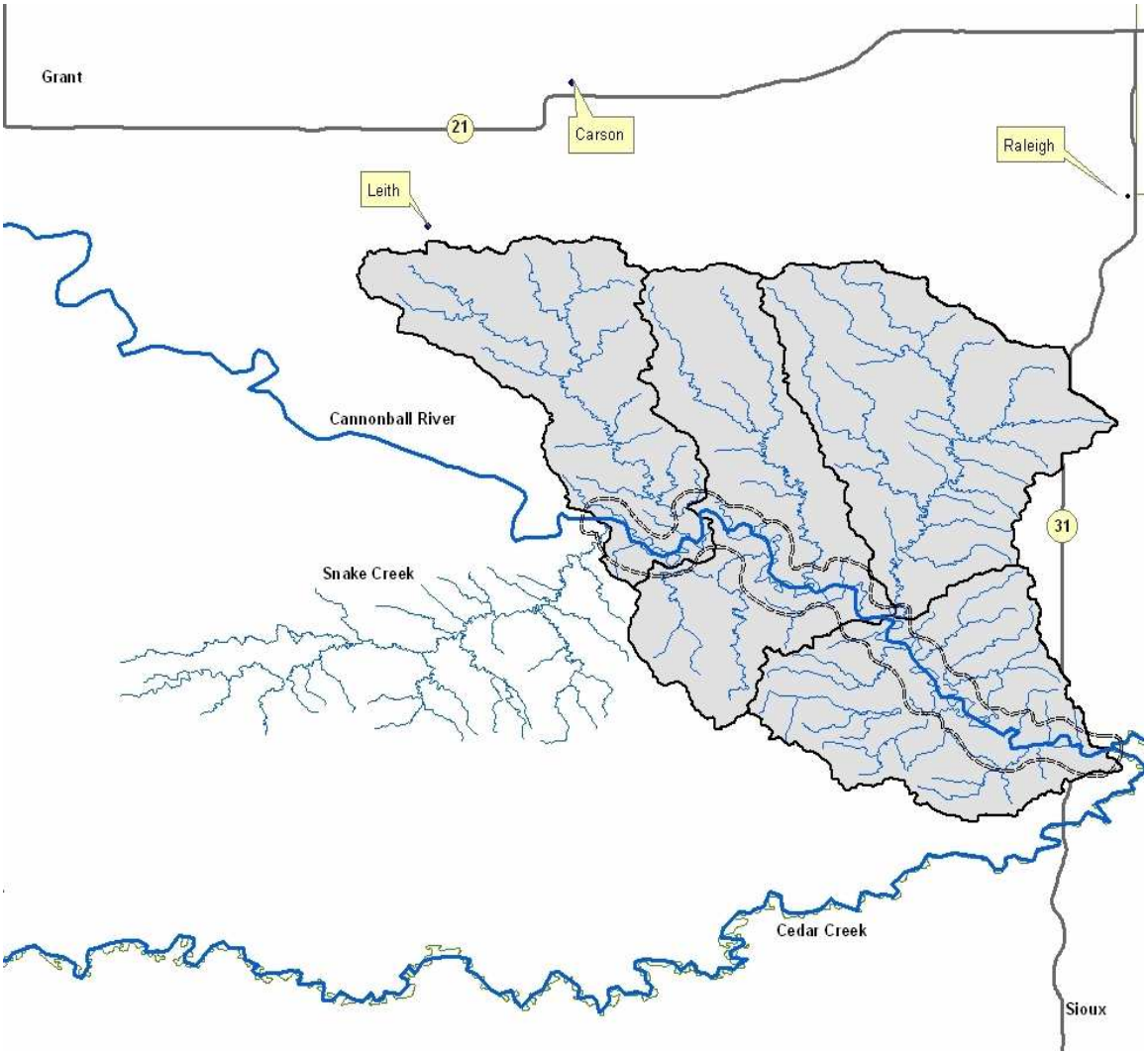
Table 1: General Characteristics of the Cannonball River and its Watershed.

Legal Name	Cannonball River
8-Digit HUC	10130204 and 10130206
Counties Traversed	Slope, Hettinger, Grant, Sioux, Morton Counties
Eco-region	Northwestern Great Plains (Level III), Missouri Plateau (Level IV)
Watershed Area	1,619,734 acres
Head Waters	Northeast Slope County
Outlet	Lake Oahe
ND Highways Crossed	Hwy 21, Hwy 22, Hwy 8, Hwy 49, Hwy 31, Hwy 6, Hwy 1806
Stream Class	Class II
Headwater Elevation	2770 feet
Outlet Elevation	1611 feet
River Length	346 miles
Annual Mean Stream flow for Year 2001	295 ft^3/s

Table 2: Cannonball River Section 303(d) Listing Information (NDDoH, 2004).

Assessment Unit ID	ND-10130204-001-S-00
Waterbody Description	Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek
Size	34.16 miles
Designated Use	Recreation
Stream Class	Class II
Use Support	Fully Supporting, but Threatened
Impairment	Total Fecal Coliform Bacteria
TMDL Priority	High, Targeted

Priority Corridor for Livestock Grazing Management Planning



Appendix #3

Quality Assurance Project Plan

(QAPP)

Quality Assurance Project Plan
for the
Cannonball River TMDL Implementation Project

Prepared for the
Grant County Soil Conservation District
Carson, ND

Prepared by:
Paul L. Keeney, Environmental Scientist
and
Michael J. Ell, Environmental Administrator
Surface Water Quality Management Program
Division of Water Quality
North Dakota Department of Health
Bismarck, ND

Draft
October 2006

This quality assurance project plan (QAPP) has been prepared to ensure that environmental and related data collected, compiled, and/or generated for this program/project are complete, accurate, and of the type, quantity, and quality required for their intended use. The work conducted will be in conformance with the Quality Management Plan (QMP) for the Department's Environmental Health Section (NDDH, June 2000) and with the procedures described in this QAPP. The QMP and this QAPP reflect provisions from the Environmental Protection Agency (EPA) entitled "EPA Requirements for Quality Assurance Project Plans" (March 2001).

Approvals:

_____ _____ _____	_____
Michael J. Ell Date	Dana K. Mount, P.E. Date
Program Manager	Quality Assurance Coordinator
Surface Water Quality Management Program	Environmental Health Section
Division of Water Quality	North Dakota Department of Health
North Dakota Department of Health	Bismarck, ND
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A. Project Management

A1. Project/Task Organization

This Quality Assurance Project Plan (QAPP) describes the quality assurance (QA) and quality control (QC) activities/procedures that will be used while collecting samples for the Cannonball River TMDL Implementation Project in Grant County, North Dakota. The purpose of this document is to present the methods and procedures that will be used to collect biological samples and measurements from the Cannonball River watershed in Grant County, as well as the quality assurance procedures that will be employed.

The US Environmental Protection Agency (EPA) Region 8 has provided funding for this project through the Section 319 Nonpoint Source Pollution Program. This program is part of the Surface Water Quality Management Program (SWQMP) of the North Dakota Department of Health, administered by the Division of Water Quality. The Project Officer for the US EPA Region 8 is Brad Crowder.

Overall organization for the North Dakota Department of Health's (NDDoH) Environmental Health Section (EHS) is detailed in the Quality Management Plan (QMP) for the Environmental Health Section (NDDH, June 2000)[1]. The EHS is one of six sections in the NDDoH. Within the EHS there are five divisions, including the Divisions of Air Quality, Municipal Facilities, Waste Management, Water Quality, and Laboratory Services. Dana K. Mount, P.E. is the Quality Assurance Coordinator (QAC) for the EHS. The QAC is located in the EHS Chief's Office and reports directly to the Chief of the EHS. The EHS Chief's Office through the QAC is responsible for oversight of the EHS's quality system for QA and QC as delineated in the Quality Management Plan for the Environmental Health Section, including approving project QAPPs. It is the policy of the EHS that the primary responsibility for QA resides among program staff and Designated Project Managers (DPMs) in each division, therefore each program is responsible for the preparation, implementation, and assessment of its QAPP(s).

Within the EHS, the Division of Water Quality is organized into three programs: the North Dakota Permit Discharge Elimination System (NDPDES) Program, the Groundwater Program, and the Surface Water Quality Management Program (SWQMP). The Cannonball River TMDL Implementation Project is the responsibility of the SWQMP, in cooperation with the Grant County Soil Conservation District. The organizational structure for the project is outlined in Figure 1.

[1] This QAPP was prepared according to the EHS's QMP, which has been approved by EPA.

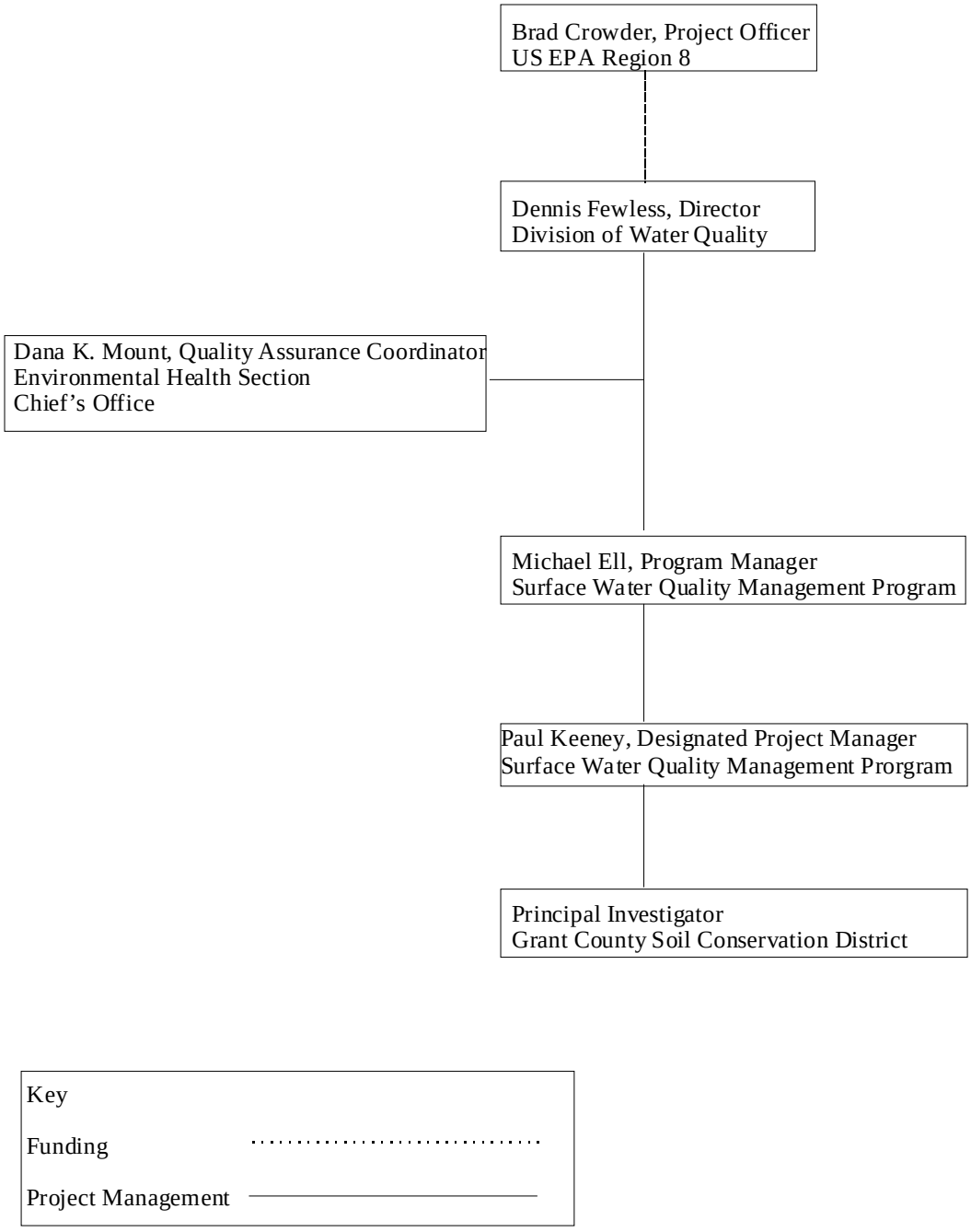

Figure 1. Organizational Diagram for the Cannonball River TMDL Implementation Project.

Michael J. Ell is Program Manager for the SWQMP. As Program Manager in the SWQMP he has the following responsibilities:

- review and edit the QAPP;

- provide oversight for study design, site selection, and adherence to design objectives;

- review and approve the final project work plan and other materials to support the project (e.g., standard operating procedures);

- select appropriate project subcontractors, as needed; and

- coordinate with contractors, reviewers, and US EPA to ensure technical quality and contract adherence.

Paul Keeney is an Environmental Scientist with the SWQMP and is the Designated Project Manager (DPM) for the Cannonball River Watershed Implementation Project. As such, he is responsible for overall project coordination and supervision, including the reduction and analysis of project data and the preparation of the final report.

For purposes of this project, project implementation has been contracted to the Grant County Soil Conservation District. Joyce Bonogofsky is the principal investigator. As principle investigator, Joyce Bonogofsky will complete the field investigations and data collection, analysis, and all reporting with Paul Keeney and the SWQMP. The principal investigator will be responsible for day-to-day project oversight, data collection and sample custody. The principal investigator will be responsible for data interpretation and report preparation.

A2. Problem Definition/Background

The Cannonball River flows through five counties in southwest North Dakota, providing recreational and agricultural water supply while it delineates county lines as it flows into Lake Oahe. Originating in the northeast corner of Slope County, the Cannonball River winds its way in a southeasterly direction across Hettinger and Grant Counties where it confluences with Cedar Creek. At its confluence with Cedar Creek, the Cannonball River changes direction flowing northeast bisecting Sioux and Morton counties where it discharges into Lake Oahe. Encompassing two sub-basins, the Cannonball River TMDL Implementation Project is part of the Missouri River Basin.

Based on the 2004 Section 303(d) List of Impaired Waters needing TMDL's (NDDoH, 2004), the North Dakota Department of Health has identified a 34.16 mile segment of the Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek (ND-10130204-001-S 00) as fully supporting, but threatened for recreational uses. Recreational uses on the Cannonball River are threatened due to excessive fecal coliform bacteria concentrations. Fecal coliform bacteria levels periodically exceed the State Standard, and E. coli bacteria originating

from human sources have been discovered in the river. Recognized as a high priority area, a TMDL (Total Maximum Daily Load) was written and open for public comment on this segment of the Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek and finalized in March of 2005. This 34.16 mile segment of the Cannonball River has approximately 110,403 acres (hydrologic unit 10130204) with an average of 16 inches of rainfall a year.

In response to the completed TMDL for the 34 mile segment of the Cannonball River, and the fecal coliform and E. coli bacteria impairments present in the waterbody, the Grant County Soil Conservation District has initiated a TMDL implementation project. This five year project will focus its efforts on livestock Best Management Practices (BMP's) within one half mile of the riparian area of the Cannonball River, as well as the installation of agricultural waste systems for cooperating producers in the supporting watershed. This project intends to restore the beneficial uses of this segment of the Cannonball River to fully supporting by suppressing the concentrations of fecal coliform and E. coli bacteria through BMP implementation efforts.

A3. Project Monitoring Goals/Objectives/Tasks Description

The primary goal of this project is to determine the effectiveness of best management practices implemented over the life of the TMDL implementation project in Grant County. The pollutant of concern is total fecal coliform bacteria and E. coli and will be sampled in 2007-2011 to track the water quality response of the project.

The following objectives and tasks are intended to achieve the monitoring goals of the project. Specific products and milestones are provided with each task.

Objective 1: Conduct a project literature review and prepare a quality assurance project plan (QAPP).

Task 1: Conduct a literature review of research related to sampling methods and existing data for the Cannonball River and its tributaries in HUC unit 10130204.

Product: Literature review and bibliography.
Milestone: September 2006

Task 2: Select sampling sites within the 34.16 mile reach of the Cannonball River TMDL Implementation Project.

Product: A set of sample sites reflecting the hydrology of the Cannonball River and its tributaries.
Milestone: October 2006

Task 3: Prepare a QAPP and submit it to EHS QAC for approval.

Product: An approved QAPP.
Milestone: November 2006

Objective 2: Collect and analyze biological data from the sampling sites in the Cannonball River watershed.

Task 4: Collect and analyze a minimum of 5 fecal coliform and E. coli bacteria samples per month at each sampling site during the recreation season (May 1 – September 30). Each is located on discrete sub-basins within the watershed (Figure 2).

Product: Water quality samples from each stream sampling site.
Milestone: 2007-2011.

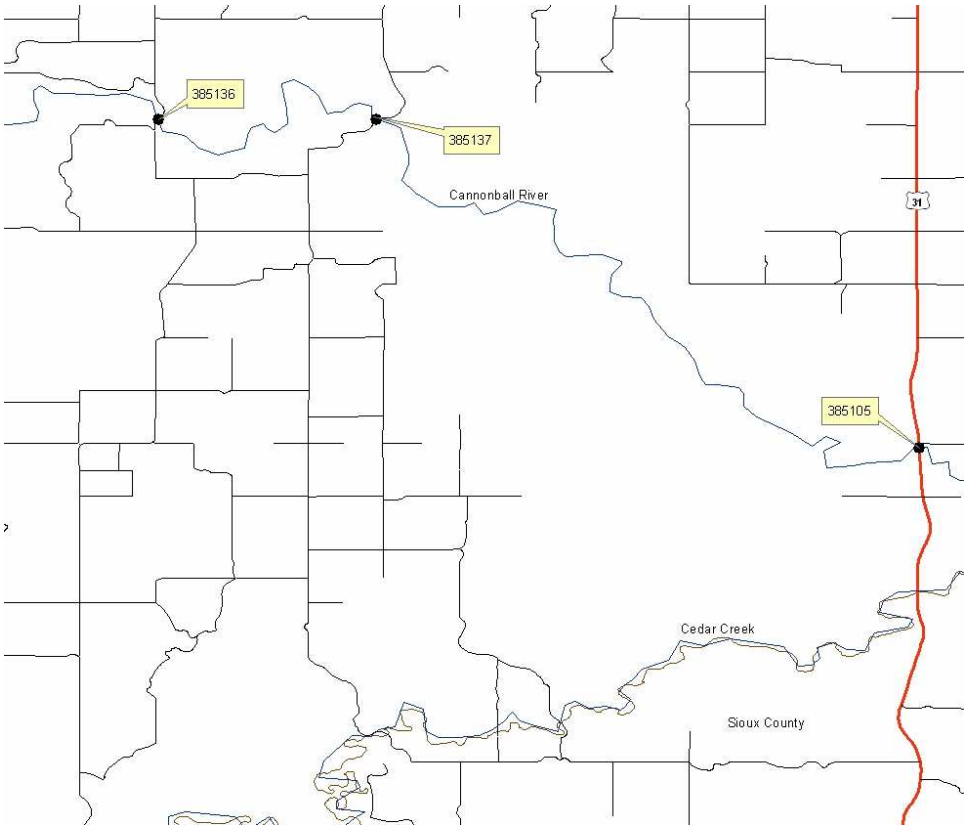

Figure 2. Location of water quality monitoring sites on Cannonball River in Grant County.

Objective 3: Estimate annual load reductions resulting from the installation of agricultural waste systems in the project area.

Task 7: Utilize the Animal Feedlot Runoff Risk Index Worksheet to estimate nutrient loads before and after the installation of each agricultural waste system. (Appendix A). A full copy of the AFRRI can be obtained from the NDDoH.

Product: A manure calibration model defining the initial nutrient load and load reduction associated with each agricultural waste system.
Milestone: November 2011.

A4. Data Quality Objectives and Criteria for Measurement Data

A4.1 Data Quality Objectives

It is the policy of the US EPA and the Department's EHS that data quality objectives (DQOs) be developed for all environmental data collection activities. Data of known quality are essential to the success of any monitoring or sampling project. Data quality objectives are qualitative and quantitative statements that clarify the intended use of the data, define the type of data needed to support the decision, identify the conditions under which the data should be collected, and specify tolerable limits on the probability of making a decision error due to uncertainty in the data. DQOs are developed by data users to specify the data quality needed to support specific decisions. Sources of error or uncertainty include the following:

- Sampling error: The difference between sample values and *in situ* true values from unknown biases due to collection methods and sampling design;

- Measurement error: The difference between sample values and *in situ* true values associated with the measurement process;

- Natural variation: Natural spatial heterogeneity and temporal variability in population abundance and distribution; and

- Error sources or biases associated with compositing, sample handling, storage, and preservation.

Methods and procedures described in this document are intended to reduce the magnitude of the sources of uncertainty (and their frequency of occurrence) by applying the following approaches:

- use of standardized sample collection, handling, and analysis procedures; and

- use of trained scientists and technicians to perform the sample collection and handling activities.

A4.2 Measurement Performance Criteria

In order to meet the DQO for the project, the types of data needed for this project and their intended use are described in Table 1. For each of these data, a discussion of the measurement performance criteria or data quality indicators is provided. Data quality indicators include the following:
- precision;
- accuracy;
- representativeness;
- completeness; and

- comparability.

This QAPP does not address measurement performance criteria for the laboratory analysis of chemical samples. Measurement performance criteria for all lab analysis is described in the NDDoH, Division of Chemistry, Quality Assurance Plan (NDDoH 2000).

Table 1. Project Data Needs and Intended Uses.

Data Needed	Intended Use
Watershed/land use characteristics (e.g. AgNPS input variables)	Characterize sources of total fecal coliform and E. coli bacteria within the watershed and develop a watershed model that can be used to predict changes in loading due to changes in land use practices.
Stream biological characteristics (e.g. total fecal coliform and E. coli bacteria)	Characterize stream water quality in the watershed and estimate total fecal coliform and E. coli bacteria loading.

Precision is a measure of mutual agreement among individual measurements or enumerated values of the same property of a sample, usually under demonstrated similar conditions. Precision is best measured in terms of the standard deviation. For purposes of this project, precision of biological samples and chemical analysis will be calculated from replicate samples and expressed as relative percent difference (RPD), if it is calculated from duplicate samples, or as relative standard deviation (RSD), if it is to be calculated from three or more samples. Table 2 provides a summary of the precision requirements for data collected for this project.

Accuracy is the degree of agreement between an observed or measured value and the true or expected value of the measured quality. Many kinds of error, including unintentional bias affect the inherent accuracy of data. Unfortunately, true population values are almost never known to the investigator. This is especially true when working with natural biological communities. Therefore, the best an investigator can do is to avoid bias by assuring consistency of sampling and sample processing and striving for repeatability of measurements. Table 2 provides a summary of the accuracy requirements for data collected for this project.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter, variation at a sampling point, a process condition, or an environmental condition. The representativeness of the project relies in part, on the selection of sample sites and the collection of a significant number of samples.

Completeness is defined as the percentage of measurements made that are judged to be valid according to specific criteria and entered into the data management system. To optimize completeness, every effort is made to avoid sample and/or data loss. Accidents during sample transport or lab activities that cause the loss of the original samples will result in irreparable loss of data, which will reduce the ability to perform analysis, integrate results, and prepare reports. In order to maximize completeness, all samples will be stored and transported in unbreakable (plastic) containers.

Percent completeness (%C) for measurement parameters and samples is defined as:

$$\%C = v/T \times 100$$

where v = the number of measurements or samples judged valid; and
T = the total number of measurements of samples collected.

In order to fulfill statistical criteria, samples will be collected at 100% of the sites unless unanticipated conditions (i.e. bad weather) prevent sampling. Table 2 provides a summary of the completeness requirements for data collected for this project.

Comparability is a measure of the confidence with which one data set can be compared to another. Comparability is dependent on the proper design of the sampling program and on strict adherence to accepted sampling techniques, standard operating procedures, and quality assurance guidelines. For this project, comparability of data will be accomplished by standardizing the sampling season, the geographic extent of the project, the field sampling methods, and the field training as follows:

- All samples will be collected from specific stream sites located within the Cannonball River watershed (figure 2). The project sampling period will be during the open water periods of 2007-2011.

- Standard sampling and analytical methods, as well as standard units of reporting for all parameters sampled will be used (Appendix B).

- All field personnel involved with sampling will have adequate training and experience.

Table 2. Summary of Precision, Accuracy, and Completeness Requirements for Measurement Data.

Measurement Parameter	Precision	Accuracy	% Completeness
Stream Water Chemistry	20%	NA	95%
AgNPS/ Model Variables	NA	NA	100%

A5. Special Training/Certification

The Principal Investigator (PI) will be responsible for all field water quality and AgNPS data collection. The field sampling crew is required to have the necessary knowledge and experience to perform all field activities. Training in the proper methods for sample collection, preservation, and the transfer of water chemistry samples will be provided by Paul Keeney, Designated Project Manager.

A6. Documents and Records

Thorough documentation of all field sampling and handling activities is necessary for proper processing in the laboratory, data reduction and, ultimately, for the interpretation of study results. Field sample collection and handling will be documented in writing. The following forms and labels will be used.

- a set of Sample Identification/Custody Record forms that accompanies each water chemistry and TSS samples submitted to the Division of Laboratory Services - Chemistry for analysis (Appendix B);

- a Sample Identification Label that accompanies and identifies all water samples (Appendix B);

Each sample collected will be uniquely identified on the sample label and field custody forms by specifying the site ID and location; sample depth; sample date and time and person collecting the sample.

B. Data Generation and Acquisition

B1. Sampling Process Design

B1.1 Monitoring Goal

The primary goal of monitoring is to track trends in the biological condition of the streams, identify which the BMPS are most effective, and to the extent possible identify if the pollution abatement project is being effective at restoring and maintaining the biological condition of the streams in the Cannonball River watershed to fully supporting the beneficial uses of aquatic life and recreation.

B1.2 Sample Locations

Three stream sites have been selected for the Cannonball River Watershed Implementation Project. Monitoring sites will be sampled throughout the open water season (Table 3 and figure 2). Sampling frequency for the stream sampling sites will be stratified to coincide with the typical hydrograph for the region. This sampling design will result in more frequent sampling during spring and early summer, typically when stream discharge is greatest and less frequent sampling during the summer and

fall. Sampling will be discontinued during winter ice cover. Sampling will also be terminated if the stream stops flowing. If the stream should begin flowing again, water quality sampling will be reinitiated. Table 3 provides a summary of the stream sampling site locations.

Table 3. Lower Cannonball River Water Quality Stream Sampling Sites.

STORET Number	Site Description and Location
385136	**Site #1: 1 mile East, 13 miles South of Carson, ND.** **Lat: 46.22245N Long: 101. 5398W**
385137	**Site #2: 4 miles East, 13 miles South of Carson, ND.** **Lat: 46.221417N Long: 101.478433W**
380105	**Site #3: 16 miles South of Raleigh, ND on Hwy 31 Bridge.** **Lat: 46.12676N Long: 101.33283W**

B2. Sampling Methods

Table 4 provides a summary of project sampling methods. Detailed descriptions of all field sampling methods are described in Appendix B.

Samples collected for fecal coliform analysis must be collected and sent on Mondays, Tuesdays or Wednesdays to insure the timely delivery and analysis of samples.

Table 4. Summary of Project Sampling Methods.

Matrix/ Substrate	Parameter	Sampling Equipment	Max Holding Time	Sample Container	Sample Preser-vation and Care
Stream Water	Chemistry	1	1	1	1

1-See Appendix B

B3. Sample Handling and Custody Requirements

Analysis of all water quality samples collected from monitoring sites will be performed by the NDDoH, Division of Chemistry. Immediately after collection, water chemistry samples and sample custody reports will be sent to the Division of Chemistry laboratory in Bismarck, ND at the following address:

N.D. Department of Health
Laboratory Services - Chemistry
2635 East Main----------UPS
P.O. Box 937----------USPS
Bismarck, ND 58502-0937

B4. Analytical Methods Requirements

All water samples will be analyzed according to methods and procedures described in the NDDoH Division of Chemistry's Quality Assurance Plan (NDDoH 2000).

B5. Quality Control

For this project, the majority of the measurements will be taken in the field by a single person. Equipment used for field measurement will be calibrated immediately before and after each sampling trip. Furthermore, field duplicate samples will be collected with ten percent of the stream water samples collected for chemical analysis.

B6. Instrument/Equipment Testing, Inspection, and Maintenance

All field equipment will be inspected prior to sampling activities to ensure that proper use requirements are met (e.g., water samplers are without defects, temperature and DO meters properly calibrated). Inspection of field equipment will occur in advance of field activities to allow time for replacement or repair of defective equipment. The Principal Investigator should gather and inspect all equipment prior to each sampling trip.

B7. Instrument Calibration and Frequency

As part of instrument and equipment maintenance, flow, temperature and dissolved oxygen meters will be calibrated daily according to the manufacturer's specifications. In addition, the thermometer will be calibrated in the lab prior to the field season against an ASTM standard thermometer and again at the end of the field season to determine drift.

B8. Inspection/Acceptance of Supplies and Consumables

Careful and thorough planning is necessary to ensure the efficient completion of the field sample collection tasks. A general checklist of field equipment and supplies is provided in the description of the SOPs (Appendix B). It is the responsibility of the Principal Investigator to gather and inspect the necessary sampling gear prior to each sampling trip.

B9. Data Acquisition Requirements (Non-direct Measurements)

Non-direct measurements will include identification and/or verification of each sample location (i.e., latitude and longitude) with the use of a calibrated GPS unit. The latitude

and longitude coordinates, in decimal degrees, will be recorded. A hard copy table of the location of each sampling site and a map depicting each location from the ArcView Mapmaker Program will be provided by the DPM to the Principal Investigator.

B10. Data Management

Samples will be documented and tracked through sample identification labels, field and laboratory recording forms and sample identification/custody forms. Water samples collected for chemical analysis will be transported or sent to Laboratory Services - Chemistry laboratory in Bismarck, ND by field personnel (Appendix B).

Results of chemical analysis of water samples are transmitted from the Division of Chemistry to the SWQMP Program Manager via hard copy report and electronically as an ASCII text file. Results transmitted electronically are stored by the Division of Water Quality's SWQMP in an Access 2000 based data management system, termed SID (Sample Identification Database). After review by the SWQMP Program Manager, sample results will be retained by the DPM for data reduction and analysis.

C. Assessment and Oversight

C1. Assessment and Response Actions

Assessment activities and corrective actions have been identified to ensure that sample collection activities are conducted as prescribed and that the measurement quality objectives and data quality objectives established by this QAPP are met. The QA program under which this project will operate includes performance and system audits with independent checks of the data obtained from sampling activities. Either type of audit could indicate the need for corrective action. The essential steps in the program are as follows:

- identify and define the problem;

- assign responsibility for investigating the problem;

- investigate and determine the cause of the problem;

- assign and accept responsibility for implementing appropriate corrective action;

- establish effectiveness of and implement the corrective action; and

- verify that the corrective action has eliminated the problem.

Immediate corrective actions form the part of normal operating procedures and are noted on project field and laboratory recording forms and will be the responsibility of the Principal Investigator (PI). Problems not solved this way may require more formalized, long-term corrective action. In the event that quality problems requiring attention are identified, the DPM will determine whether attainment of acceptable data

quality requires either short or long-term actions. Failure in the chemical analysis system (e.g., performance requirements are not met) and corrective actions for those failures are beyond the scope of this QAPP.

Communication and oversight will proceed from the Principal Investigator to the DPM. The DPM will be available throughout the entire sampling period to address questions and receive communications of sampling status from the PI. The PI will communicate the status of the sampling activities to the DPM on a weekly basis. During this time, the PI will communicate any sampling difficulties encountered during sampling and corrective actions taken. In most cases, the PI will initiate corrective actions when a problem is immediately identified and note the problem and corrective action in his/her logbook. In the event the problem cannot be corrected immediately, the PI will contact the DPM to determine the best way to rectify the problem to obtain accurate and useable data. When corrective actions have been taken and a sufficient time period has elapsed that allows a response, the response will be compared with project goals by the DPM. The DPM will verify that the corrective action has been appropriately addressed to eliminate the problem. The DPM has the authority to stop work on the project if problems affecting data quality are identified that will require extensive effort to resolve. When the DPM is contacted with a problem, the Principal Investigator, or DPM should keep a record of the problem and the corrective action taken.

Performance audits are qualitative checks on different segments of project activities, and are most appropriate for field sampling and laboratory analysis activities. A field audit of field sampling activities will be conducted at least once during the project by the DPM. This audit will be conducted early during the project field season in case any problems are identified which can be corrected quickly to minimize the possibility of compromising data. Field audit techniques include checks on sampling equipment and the review of sampling methods.

System audits are qualitative reviews of project activity to check that overall project quality is functioning and that the appropriate QC measures identified in the QAPP are being implemented. The DPM will conduct an annual internal system audits during the project and report all deficiencies to the SWQMP Program Manager during annual reporting.

C2. Reports to Management

Problems and corrective actions identified by the PI will be reported to the DPM each week during the field season. Significant problems identified by the field personnel as well as problems and corrective actions identified by the DPM during the field audit will be reported to the SWQMP Program Manager as part of annual reports.

D. Data Validation and Usability

D1. Data Review, Validation, and Verification Requirements

Data review, validation, and verification requirements provide a method for determining the usability and limitations of data, and provide a standardized data quality assessment. All field and laboratory report forms will be reviewed by the PI and the DPM, while all sample custody forms for chemical analysis will be reviewed by the DPM for completeness and correctness. The PI will be responsible for reviewing all data entries and transmittals for completeness and adherence to QA requirements. Data quality will be assessed by comparing entered data to original data or by comparing results with the measurement performance criteria summarized in Section A4.2 to determine whether to accept, reject, or qualify the data. Results of the review and validation processes will be reported to the DPM.

D2. Verification and Validation Methods

The PI will review all field and laboratory record forms. The DPM will review a minimum of five percent of field and laboratory record forms and all of the sample custody forms for chemical analysis. Any discrepancies in the records will be reconciled with the field personnel and recorded in the logbook.

Analytical validation and verification methods are outside the scope of the QAPP. The submission of samples to Laboratory Services - Chemistry laboratory will include a Sample Identification/Custody Record sheet documenting the site location, sampling date and time. This information will be checked by the Division of Chemistry laboratory to ensure that holding times have not been exceeded. Violations of holding times will be reported by the laboratory to the DPM. The DPM, in consultation with Division of Chemistry personnel, will determine whether or not to proceed with the analysis of that sample and/or analyte.

D3. Reconciliation with Data Quality Objectives

As soon as possible after each sampling event or the analysis of each sample, calculations and determinations for precision, completeness, and accuracy will be made by the field personnel and compared to the criteria discussed in Section A4. This will represent the final determination of whether the data collected are of the correct type, quantity, and quality to support their intended use for this project. Any problems in meeting the performance criteria (or uncertainties and limitations in the use of the data) will be discussed with the PI and will be reconciled, if possible.

Literature Cited

EPA. May 2000. EPA Quality Manual for Environmental Programs. EPA Order 5360 A1. U.S. Environmental Protection Agency. Washington, D.C.

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NDDoH. June 2001. Standards of Water Quality for the State of North Dakota. NDCC 61-28-04, 23-33, 61-28. Environmental Health Section, North Dakota Department of Health, Bismarck, ND.

ND/EHS. Revision 5. 29 June 2000. Quality Management Plan for the Environmental Health Section. Environmental Health Section, North Dakota Department of Health, Bismarck, ND.

Appendix A
Animal Feedlot Runoff Risk Index

North Dakota (Modified From Utah) Animal Feedlot Runoff Risk Index - Excel Spreadsheet
Instructions for Use

General Information:

The worksheet can be cleared of all entries except todays date by holding down the "Ctrl" key while pressing the small "c" key. Enter the landowner, location, and planners name in the first three yellow boxes. Today's date is automatically displayed but may be changed if desired. Once changed, the program will no longer display today's date. Then enter the weather station that is closest to the site being evaluated. The precipitation at that site will automatically be entered in the green box below. Enter the hydrologic unit code (HUC) for the location of the lot being evaluated. Note the little red triangles in the corners of some of the cells. Slide the mouse pointer over the top of the cells and additional information or instructions will be displayed.

The spreadsheet allows two feedlots to be evaluated. A before and after project evaluation should be made. Enter a general description of the lot being evaluated. Then enter the size of the lot in square feet and the type of surface on the lot. Next enter the type of animal in the lot, average weight of the animals, and the number of days the animals are confined. If more than one animal type is confined list the type of animal that makes up the majority of the animals. Information about the number of square feet per animal will be automatically calculated. Click on the gray tab titled, "Space Requirements" for recommendations on the desired number of square feet per animal.

Feedlot Features, and Index and Risk Level

Using the point values obtained from Table 1, Feedlot Features, or the information in the red triangles, enter the number of points for each given feature (Containment, Distance, etc.). The computer will automatically calculate the index points and risk level for the described conditions. The spreadsheet must be used to document both the before and after project conditions for each feedlot evaluated.

Manure Management and Conservation Practices

Enter the frequency of hauling or scraping. The frequency of scraping should be entered only if all manure is scraped into a bunker or other structure where the manure will be contained during a 25-year, 24-hour storm. Lastly, enter the conservation practices that will be installed on the lot. A list of potential practices is given at the bottom of the worksheet page.

Loading Calculations

The computer will automatically calculate loading values. The total tons of manure is calculated first, then the amount of nitrogen, phosphorus, and BOD_5 after typical storage losses is calculated. N, P, and BOD_5 availability is also reduced based on the frequency of hauling or scraping. Total loading values are determined by multiplying the amount of the nutrient available by the listed precipitation, lot, and risk factors. Generally, the greater the precipation, the higher the factor. The harder the cover is on the lot the greater the likelihood of runoff and the higher the factor. The higher the risk factor, as entered in the feedlot features, the higher the factor.

Interpretation:

An interpretation table (vulnerability table) can be found by clicking on the tab at the bottom of the screen labeled "Intrepretation". This table explains the ratings displayed in the row labeled "risk level". To obtain additional information or help on the use of the Utah Animal Feedlot Runoff Risk Index, (UAFRRI) contact your nearest NRCS Area Agronomist or Kerry Goodrich at (801) 524-4568.

*North Dakota Animal Feedlot Runoff Risk Index Worksheet

Landowner:		**Weather Station:**	
Location:		**HUC:**	Not Designated
Planner:		**Precipitation:**	
Date:			

Lot Description:				
Planning Scenario:	**Before**	**After**	**Before**	**After**
Lot Size (Sq. Ft.):				
Surface Type:				
Animal Type:				
No. of Animals:				
Avg. Weight:				
Days Confined:				
Sq.Ft./Animal:				
Feedlot Features				
Runoff Containment				
Distance to Water				
% Slope				
Vegetation				
Clean H_20 Diversion				
Index and Risk Level				
Index:				
Risk Level:				
Manure Management and Conservation Practices				
Haul/Scrape Frequency				
Practices to be implemented				
Loading Calculations				
Fresh Manure (tons)				
Total N Available (lbs)				
Total P Available (lbs)				
Total BOD_5 Available (lbs)				
Precipitation Factor				
Lot Surface Factor				
Risk Factor				
Total N Loading (lbs)				
Total P Loading (lbs)				
Total BOD_5 Loading (lbs)				

*Modified from Utah to fit North Dakota. Individual high risk features should be evaluated and conservation practices applied where possible. All runoff from a 25-year, 24-hour storm event must be contained on the lot.

Practices that might be implemented:

Move Lot	Install Dike	Install Filter Strip
Regrade Lot	Install Diversion	Roof Runoff System
Build Storage	Increase Sq.Ft./Animal	Change Hauling Frequency
	Increase Storage	

Appendix B
Standard Operating Procedures for the Collection and Preservation of Stream and River Grab Samples for Chemical Analysis

Standard Operating Procedures for the Collection and Preservation of Stream and River of Grab Samples for Chemical Analysis

Summary

Grab samples collected for chemical analysis should be representative of the entire stream or river. To be representative, samples must be carefully collected, properly preserved, and appropriately analyzed. In general, samples should be collected from the main current of the stream or river at 60% of the total stream depth. The grab sample can be collected either by wadding or by lower a sampling device such as a kemmerer sampler or van dorn sampler from a bridge crossing.

When collecting the sample by wading, enter the stream slightly down current from sampling site then wade to the area with the greatest current. Rinse each sample bottle and lid 3 times with stream water prior to collecting the sample. Place lid on sample bottle then submerge to approximately 60 percent of the stream depth, remove the lid and allow the bottle to fill facing towards the current. Replace the lid prior to removing bottle from stream. A small portion of the sample will need to be decanted off prior to preserving and/or placing in cooler. Note: In very shallow streams care must be taken not to contaminate the sample with bottom sediments. When collecting from a bridge using a kemmerer or van dorn sampler, lower the device into the stream and trip the sampler at 60 percent of the total stream depth.

Equipment and Supplies

___2.2. or 3.2 liter non-metallic sampler (e.g., Kemmerer or Van Dorn sampler) and a messenger.
___Sample containers (Table C1)
___Acid for sample preservation (Table C1)
___Sample labels
___Sample log forms
___Coolers with ice or frozen gel packs
___Deionized water for sample blanks and decontamination
___Filter apparatus.
    For vacuum method
    ___Vacuum filter holder.
    ___Vacuum pump
    ___0.45 um membrane filters (Millipore HAWP 047 00 or equivalent).
    ___Pre-filters (Millipore AP40 0047 05 or equivalent)
    ___Stainless steel forceps
    For peristaltic method
    ___Power Drive (Compact Cat No P-07533-50 or equivalent)
    ___Peristaltic head (Easy Load II Cat No. P-77200-62 or equivalent)
    ___In-line 0.45 um cartridge filters (Geotech dispos-a-filter or equivalent).
    ___In-line 5.0 um cartridge pre-filters (Geotech dispos-a-filter or equivalent).
    ___Tubing (Masterflex silicone Cat No P-96400-24 or equivalent)
___Churn Splitter
___Sample ID/Custody Record.
___Black ballpoint pen or mechanical pencil
___Sample and blank log forms.
___Stainless steel forceps
___Field report form
___Pen

Procedure

Stream Sample Collection

1. Triple rinse each sample bottle using stream water. Note: Do not rinse the pesticide sample bottles.

2. Fill the sample bottle: Samples should be collected in the main current at that depth which is approximately 0.6 of the total water depth below the surface. When stream depth permits, a sample may be collected by wading the stream and inserting sample container facing against the current, allowing it to fill naturally at the appropriate depth. At greater water depths, an appropriate sampling device should be used. Note: Care should be taken so that the sample is not contaminated by disturbing the streambed upstream from the collection point.

3. Place the appropriate label on each sample container (Figure C1).

4. Preserve each sample appropriately, according to the label (Table C1).

5. Fill out the Sample ID/Custody Report and the water chemistry sample log.

6. When a copy of the Sample ID/Custody Report is received from the DC record the laboratory log number on the sample log form.

Stream Blank Sample Collection

1. Field blank samples are collected with first and every tenth stream sample collected (i.e., 1, 10, 20...). If the sample log indicates a blank sample be collected, follow the steps below.

2. Using deionized water, triple rinse each sample bottle.

3. Fill each bottle with deionized water.

4. Place a label on each sample container.

5. Preserve each sample appropriately, according to the label (Table C1).

6. Fill out the sample information log form (Figure C2). Note: Field sample blanks should be identified with STORET number 389990.

7. When a copy of the Sample ID/Custody Report is received from the DC laboratory record the laboratory log number on the sample log form.

Stream Duplicate Sample Collection

1. Duplicate samples are collected with the first and every following tenth stream sample collected (i.e., 1st, 10th, 20th...). If the sample log indicates a duplicate sample be collected, follow the steps below.

2. Collect the sample following steps 1 - 4 in the procedure for Stream Sample Collection.

3. Fill out the Sample ID/Custody Report (Figure C1). Note: Duplicate samples should be identified with STORET number 389999. Be sure to indicate on the label the project name and type of sample being duplicated.

4. When a copy of the Sample ID/Custody Report is received from the DC record the laboratory log number of the duplicate sample on the NPSMP water chemistry sample log form.

Stream Sample Filtration

1. Total dissolved phosphorus samples should be filtered immediately.
2. Put on new latex surgical gloves.
3. Remove filter holder from the plastic bag and assemble.
4. Rinse the filter apparatus three times with approximately 250 ml of deionized water each time.
5. Load a pre-filter in the filter apparatus and connect the vacuum pump.
6. Leach the filter twice with approximately 250 ml of deionized water each time.
7. Filter the sample through the pre-filter. Place the sample back into the sample container.
8. Remove the pre-filter from the filter apparatus and repeat Step C.
9. Load a 0.45 um filter into the filter apparatus and connect the vacuum pump.
10. Repeat Step (5).
11. Filter the sample through the 0.45 um filter.
12. Triple rinse the sample container with deionized water.
13. Transfer the filtered sample back into the sample container.
14. Preserve the sample with 2 ml 1/5 sulfuric acid or 0.2 ml concentrated sulfuric acid lowering the pH to 2 or less.
15. Place the preserved sample in the cooler on ice.
16. If additional samples require filtration, repeat Steps (3) through (15).

Field Sample Filtration Parestolic Method

1. Rinse churn splitter three (3) times with water from the stream or river.
2. Fill churn splitter with water from the appropriate stream depth.
3. Assembled and attach pump head to power drive.
4. Plug in power drive.
5. Put on new latex surgical gloves.
6. Remove acid rinsed tubing from plastic bag, taking care to prevent contamination and place in head draping a long end into the churn splitter and dangling the short end out of contact with anything.
7. Turn on pump and begin rinsing tubing with a minimum of 250 ml of sample water from churn splitter.
8. As tubing rinses remove cartridge filter from plastic bag and insert cartridge while pump is still running to the tubes dangling end. Care should be taken to ensure filter cartridge is inserted in the correct direction.
9. Run 250 ml of sample water through cartridge filter.

10. Place labels on bottles.

11. Triple rinse the sample bottles and lids with sample water coming out of the filter cartridge.

12. Fill sample bottles.

13. Preserve nutrient sample with 2 ml 1/5 sulfuric acid or 0.2 ml concentrated sulfuric acid and ICP Metals or Trace metals with 5 ml concentrated nitric acid lowering the pH to 2 or less. Note: Dissolved minerals are not preserved.

14. Place samples in the cooler on ice.

15. If cartridge becomes plugged repeat Steps (6) through (15) with a in-line 2.0 um pre-filter placed in-line prior to the 0.45 um filter.

Table B1. Summary of Analysis Request, Bottle Size, Preservative, and Holding Times

Analysis Request	**Bottle Size**	**Preservative**	**Holding Times**
Nutrients Complete	500 ml Plastic bottle	2 ml 20% H_2SO_4 Store at 4^oC	28 days
Total Dissolved Phosphorus	200 ml Plastic bottle	2 ml 20% H_2SO_4 Store at 4^oC	28 days
Total Suspended Solids (TSS)	200 ml Plastic bottle	None Store at 4^oC	7 days
Fecal Coliform Bacteria	200 ml Plastic bottle	None Store at 4^oC	6 hours

North Dakota Department of Health – Division of Water Quality Stream Water Quality Field Log

Sample Number	Storet Number	Date (mm/dd/yy)	Time (Military)	D.O. (mg/L)	Temp (Celsius)	Dup Blk	Sampler Initials	Comments

Figure B1. Stream Field Log

North Dakota Department of Health
Sample Identification/Custody Record

SFN 19220 (05-2000)

Project Information *Must be Completed by Field Personnel*	**Sample Receipt** *Must be Completed by Laboratory Personnel*
Project Code:	Received By:
Project Name:	Date Received:
	Time Received:
Account Number:	Sample Log #:

Reporting *Must be Completed by Field Personnel*	**Comments** *For Laboratory and Field Use*
Return to Sampler:	
Address:	
City/State/Zip:	☐ Multi Sample Form Used *Skip Sample and Field Info Sections*
Div. of Water Quality Contact:	Multiple Sample Set Sheet Number ***1*** of

Sample Information *Must be Completed by Field Personnel*			**Field Information** *For Field Use*	
Sampler(s):			Collection: (G)rab, (D)epth Width Composite, (T)ime Integrated:	
Station No. or STORET ID:			Cond., umhos/cm:	Avg Length (cm):
Station Loc. or Description:			pH : Temp, (°C):	Min Length (cm):
			D.O., (mg/L):	Max Length (cm):
Date of Collection:	Sample #	Out Of	Species:	Avg Weight (g):
Time of Collection:			Anatomy:	Min Weight (g):
Sample Media--(W)ater, (S)oil, (F)ish Tissue:			Composite Size:	Max Weight (g):

Analysis Requested *Must be Completed by Field Personnel: Contents of Groups Can be Found on a Copy of the Group Listings*

☐ Mic) E. Coli	☐ 25) Water-Base/Neutral Pesticide	☐ 82) Weight-BTEX
☐ Mic) Enterococci	☐ 65) Water-BTEX	☐ 117) Weight-Carbamates
☐ Mic) Fecal Coliform	☐ 21) Water-Carbamates	☐ 148) Weight-Diesel Range Organics
☐ Mic) Fecal Strep	☐ 105) Water-Chlorophyll A & B	☐ 86) Weight-Mercury
☐ 106) SW, Fish-Acid Herbicides	☐ 2) Water-Complete	☐ 88) Weight-Nitrate+Nitrite
☐ 108) SW, Fish-B/N Insecticides	☐ 35) Water-Conductivity	☐ 85) Weight-PCB
☐ 76) SW, Fish-Mercury	☐ 146) Water-Diesel Range Organics	☐ 136) Weight-Phosphorus
☐ 107) SW, Fish-PCB	☐ 3) Water-Lagoon Discharge	☐ 54) Weight-SemiVOC's
☐ 78) SW, Fish-Trace Metals	☐ 41) Water-Nitrate+Nitrite	☐ 134) Weight-TKN
☐ 81) SW, Sed.-Trace Metals	☐ 84) Water-PCB	☐ 49) Weight-Trace Metals
☐ 5) SW-Major Cation/Anions	☐ 52) Water-SemiVOC's	☐ 46) Weight-VOC's
☐ 30) SW-Nutrients, Complete	☐ 83) Water-Trace Metals	☐ Other Analysis (Write in)
☐ 6) SW-Nutrients, Partial	☐ 118) Water-TSS	
☐ 50) SW-Nutrients, Tot. Diss. P	☐ 29) Water-Uranium	
☐ 7) SW-Trace Metals	☐ 28) Water-VOC's	
☐ 144) SW-Trace Metals, Dissolved	☐ 24) Weight-Acid Herbicides	
☐ 23) Water-Acid Herbicides	☐ 135) Weight-Ammonia	
☐ 34) Water-Ammonia	☐ 26) Weight-Base/Neutral Pesticides	

Copies: ***White - Chemistry Laboratory*** ***Canary - Division of Water Quality*** ***Pink - Microbiology Laboratory*** ***Goldenrod -*** **Sampler**

Figure B2. Sample Identification/Custody form.

Project Description
Sample ID **Project Description**

Analysis: (DC Code) SW-Analyte Group
Container: Preservative:
Date:_ /_ /_ Time:_ :_ Depth:
Sampler

a. Water Chemistry Label

Project Description
389999 **Project Description**

Analysis: (DC Code) SW-Analyte Group
Container: Preservative:
Date:_ /_ /_ Time:_ :_ Depth:
Sampler

b. Water Chemistry Blank Label

Project Description
389990 **Project Description**

Analysis: (DC Code) SW-Analyte Group
Container: Preservative:
Date:_ /_ /_ Time:_ :_ Depth:
Sampler

c. Water Chemistry Duplicate Label

Figure B3. SWQMP Water Chemistry Label, Water Chemistry Blank Label, and Water Chemistry Duplicate Label.

Appendix #4

Milestone Table

MILESTONE TABLE FOR CANNONBALL RIVER TMDL IMPLEMENTATION PROJECT

GOALS FOR THE PROJECT:

Achieve fully supporting status for the recreational uses on the portion of the Cannonball River from its confluence with Snake Creek downstream to its confluence with Cedar Creek.

The following partners provide assistance on the tasks under each objective listed on this table:

Group 1 - **Natural Resources Conservation Service** - Provide technical assistance for developing and carrying out the project.

Group 2 - **Grant County Soil Conservation District -** Assist in providing guidance documents, training, and local program management.

Group 3- **North Dakota State Health Department** - Section 319 program management including oversight of 319 planning and expenditures.

MILESTONE TABLE FOR CANNONBALL RIVER TMDL IMPLEMENTATION PROJECT

TASK/RESPONSIBLE ORGANIZATIONS	Product	QTY	2007	2008	2009	2010	2011
A. OBJECTIVE: Maintain the geometric mean concentrations for fecal coliform bacteria below 200 colonies/100 mL and reduce the occurrence of single samples exceeding 400 colonies/100 mL to represent less than 10% of samples.							
Task 1 - Employ a Watershed Coordinator to provide one on one conservation planning assistance to producers in the project area. Group # 2, 3	1 Watershed Coordinator	1					
Task 2 - Employ a part time Administrative Assistant to provide accounting assistance. Group # 2, 3	1 Admin. Assistant	1					
Task 3 - Provide financial and technical assistance to producers to plan and install BMP's that will improve management on 30,000 acres of range/pasture land within 1/2 mile of the riparian area of the main stream or its tributaries. Group # 1, 2, 3	Managed acres	30,000 ac					
Task 4 -Coordinate with the Department of Ag or the Stockmen's Association to design and implement 12 Ag Waste Systems in a direct link to improve the water quality in the Cannonball River TMDL Implementation Project, within 1/2 mile of the riparian area of the main stream or its tributaries. Group # 1, 2	12 approved/ permitted Ag Waste systems.	12					

Group 1 - Natural Resources Conservation Service

Group 2 - Grant County Soil Conservation District

Group 3 - North Dakota State Health Department

MILESTONE TABLE FOR CANNONBALL RIVER TMDL IMPLEMENTATION PROJECT

TASK/RESPONSIBLE ORGANIZATIONS	Product	QTY	2007				2008				2009				2010				2011			
B. OBJECTIVE: Educating producers on options for improving manure management.																						
Task 5 -Organize and conduct scheduled I/E events focusing on manure management practices and manure utilization. Group # 1, 2	Workshops	5																				
Task 6 -Organize and conduct scheduled I/E events focusing on manure management practices and manure utilization. Group # 1, 2	Tours/Demonstrations	10																				
Task 7 -Organize and conduct scheduled I/E events focusing on manure management practices and manure utilization. Group # 1, 2	Informational Meetings	5																				

Group 1 - Natural Resources Conservation Service
Group 2 - Grant County Soil Conservation District
Group 3 - North Dakota State Health Department

Appendix #5

Budget Tables

CANNONBALL RIVER TMDL IMPLEMENTATION PROJECT

FROM SNAKE CREEK CONFLUENCE TO CEDAR CREEK CONFLUENCE

BUDGET TABLE

PART 2: Section 319 / Non-Federal Budget Funds	**2007**	**2008**	**2009**	**2010**	**2011**	**TOTAL**	***FUNDING***		
							Cash Costs	**In-Kind Match***	**319 Match**
1) Salary/Fringe - Watershed Coordinator (full-time : 2080 hrs.)	$ 22,000	$ 23,040	$ 24,080	$ 25,120	$ 26,160	**$ 120,400**	**$ 24,080**	**$ 24,080**	**$ 72,240**
2) Salary/Fringe - Admin. Assistant (part-time : 48 hrs./yr.)	$ 540	$ 564	$ 588	$ 612	$ 636	**$ 2,940**	**$ 588**	**$ 588**	**$ 1,764**
3) Travel (1,000 miles/per year at $.375/mile)	$ 375	$ 375	$ 375	$ 375	$ 375	**$ 1,875**	**$ 375**	**$ 375**	**$ 1,125**
4) Equipment/Supplies ($30/mo.)	$ 360	$ 360	$ 360	$ 360	$ 360	**$ 1,800**	**$ 360**	**$ 360**	**$ 1,080**
5) Training (2 training sessions/yr.)	$ 500	$ 500	$ 500	$ 500	$ 500	**$ 2,500**	**$ 500**	**$ 500**	**$ 1,500**
6) Telephone/Postage (12/mo @ $30/mo.)	$ 360	$ 360	$ 360	$ 360	$ 360	**$ 1,800**	**$ 360**	**$ 360**	**$ 1,080**
Subtotals	*$ 24,135*	*$ 25,199*	*$ 26,263*	*$ 27,327*	*$ 28,391*	***$ 131,315***	***$ 26,263***	***$ 26,263***	***$ 78,789***
OBJECTIVES 1: Maintain the geometric mean concentrations for fecal coli form bacteria below 200 colonies/100mL and reduce the occurrence of single samples exceeding 400 colonies/100 mL to represent less than 10% of									
1) Implement BMP Practices (see Task 3)	$ 26,959	$ 26,959	$ 26,959	$ 26,959	$ 26,959	**$ 134,793**	**$ 26,959**	**$ 26,959**	**$ 80,876**
2) Prescribed Grazing (In-Kind)	$ -	$ -	$ 50,000	$ 50,000	$ 50,000	**$ 150,000**		**$ 150,000**	
Subtotals	*$ 26,959*	*$ 26,959*	*$ 76,959*	*$ 76,959*	*$ 76,959*	***$ 284,793***	***$ 26,959***	***$ 176,959***	***$ 80,876***
OBJECTIVE 2: Increase livestock producers' awareness and understanding of various management options that will reduce or prevent the delivery of livestock manure to nearby water bodies.									
1) Manure mangement workshops (5)	$ 500	$ 500	$ 500	$ 500	$ 500	**$ 2,500**	**$ 500**	**$ 500**	**$ 1,500**
2) Field Tours and demonstrations (10 - tours)	$ 1,000	$ 500	$ 1,000	$ 500	$ 1,000	**$ 4,000**	**$ 800**	**$ 800**	**$ 2,400**
3) Information/Education Meetings (5 mtgs.)	$ 500	$ 500	$ 500	$ 500	$ 500	**$ 2,500**	**$ 500**	**$ 500**	**$ 1,500**
Subtotals	*$ 2,000*	*$ 1,500*	*$ 2,000*	*$ 1,500*	*$ 2,000*	***$ 9,000***	***$ 1,800***	***$ 1,800***	***$ 5,400***
TOTAL 319/NON-FEDERAL BUDGET	**$ 53,094**	**$ 53,658**	**$ 105,222**	**$ 105,786**	**$ 107,350**	**$ 425,108**	**$ 55,022**	**$ 205,022**	**$ 165,065**

CANNONBALL RIVER TMDL IMPLEMENATION PROJECT
CONFLUENCE OF SNAKE CREEK TO CONFLUENCE OF CEDAR CREEK
PART 3: Selected Best Management Practices (BMPs)

								FUNDING		
Land Use Code	**NRCS Code**	**Practice**	**No.**	**Acres**	**Linear Feet (LF)**	***Rate***	**TOTAL**	**Cost-share Rate**	**Cash Costs**	**319 Match**
2, 3, 4	382	Fencing			20,933	*$ 0.85*	$ 17,793	60%	$ 7,117	**$ 10,676**
2, 3, 4	516	Pipelines			15,000	*$ 4.00*	$ 60,000	60%	$ 24,000	**$ 36,000**
3	528	Prescribe Grazing		30,000		*$ 5.00*	$ 150,000	60%	$ 150,000	**$ -**
2, 3	614	Trough & Tank	20			*$ 1,200.00*	$ 24,000	60%	$ 9,600	**$ 14,400**
2, 3, 4	642	Well (livestock only)	15			*$ 2,200.00*	$ 33,000	60%	$ 13,200	**$ 19,800**
		SUBTOTALS	**35**	**30,000**	**35,933**		**$ 284,793**		**$ 203,917**	**$ 80,876**

Land Use Codes: 1 = Cropland 2 = Pasture Hayland 3 = Rangeland 4 = Farmstead/Misc

CANNONBALL RIVER TMDL IMPLEMENTATION PROJECT
CONFLUENCE OF SNAKE CREEK TO CEDAR CREEK CONFLUENCE
BUDGET TABLE

PART 1: FUNDING SOURCES	2007	2008	2009	2010	2011	TOTAL
EPA SECTION 319 FUNDS						
1) FY06 319 Funds (FA)	$ 33,013	$ 33,013	$ 33,013	$ 33,013	$ 33,013	$ 165,065
Subtotals	***$ 33,013***	***$ 33,013***	***$ 33,013***	***$ 33,013***	***$ 33,013***	***$ 165,065***
OTHER FEDERAL FUNDS						
1) NRCS (TA)(FA)	$ 6,400	$ 6,400	$ 6,400	$ 6,400	$ 6,400	$ 32,000
2) NRCS EQIP & WHIP (FA)	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 12,500
Subtotals	***$ 8,900***	***$ 8,900***	***$ 8,900***	***$ 8,900***	***$ 8,900***	***$ 44,500***
STATE/LOCAL MATCH						
1) Local SCD (FA)	$ 100	$ 100	$ 100	$ 100	$ 100	$ 500
2) Local SCD (TA)	$ 10,505	$ 10,505	$ 10,505	$ 10,505	$ 10,505	$ 52,526
3) Cooperative Extension (TA)	$ 75	$ 75	$ 75	$ 75	$ 75	$ 375
4) Grant County Commissioners (TA)	$ 50	$ 50	$ 50	$ 50	$ 50	$ 250
5) Grant County Water Res. Brd. (In-Kind)	$ 75	$ 75	$ 75	$ 75	$ 75	$ 375
6) Grant County Participating Producers (TA)	$ 10,783	$ 10,783	$ 10,783	$ 10,783	$ 10,783	$ 53,917
7) BMP (In-Kind match)	$ -	$ -	$ 50,000	$ 50,000	$ 50,000	$ 150,000
Subtotals	***$ 21,589***	***$ 21,589***	***$ 71,589***	***$ 71,589***	***$ 71,589***	***$ 257,943***
TOTAL BUDGET	**$ 63,502**	**$ 63,502**	**$ 113,502**	**$ 113,502**	**$ 113,502**	**$ 467,508**

FA = Financial Assistance
TA = Technical Assistance
FSA = Farm Services Agency
SCD = Soil Conservation District
NDDH = North Dakota Department of Health Dept.
NRCS = Natural Resources Conservation Service